DEC 28 1931

ELECTRICAL WORLD

DECEMBER 26, 1931
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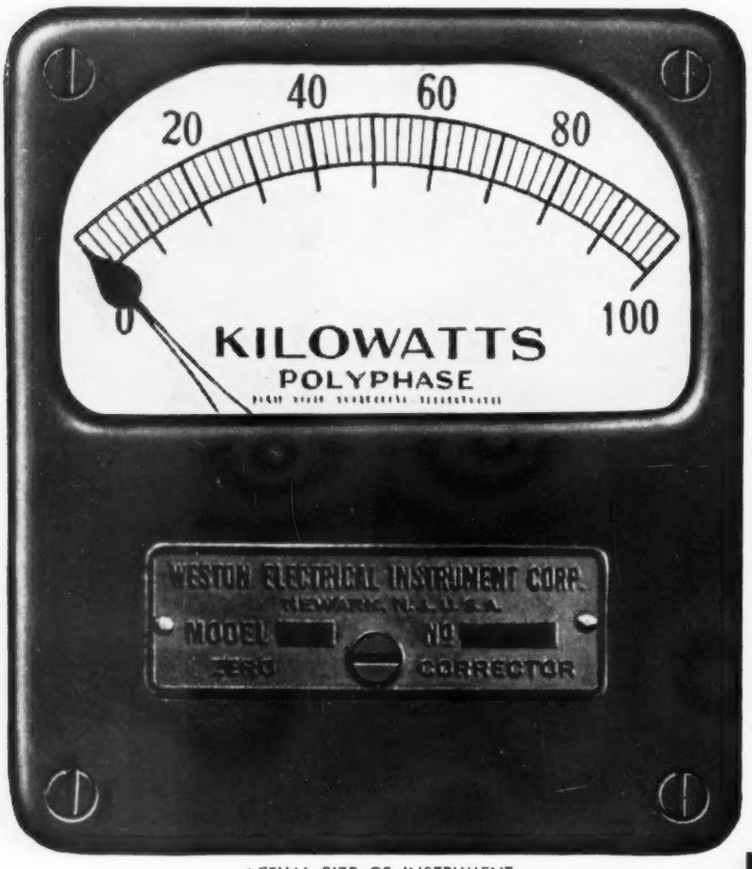
THE TREND TODAY IS TOWARD PYREX POWER INSULATORS

1930
1929
1928
1927
1926
1925

Pyrex is the registered trade mark of Corning Glass Works, Corning, N. Y., and indicates their brand of resistant glass.



ACTUAL SIZE OF INSTRUMENT

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To meet this trend, Weston developed the new Model 610's—a comprehensive line of miniature rectangular switchboard instruments only 4 inches wide—for standard switchboard use.

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9. Practical freedom from maintenance—Weston's inimitable, sturdy, precise construction.
10. Ease of repair when damaged by unusually severe service—complete movement assembly easily removed.
11. Ease of inspection—all instrument and instrument transformer connections accessible at front of board.

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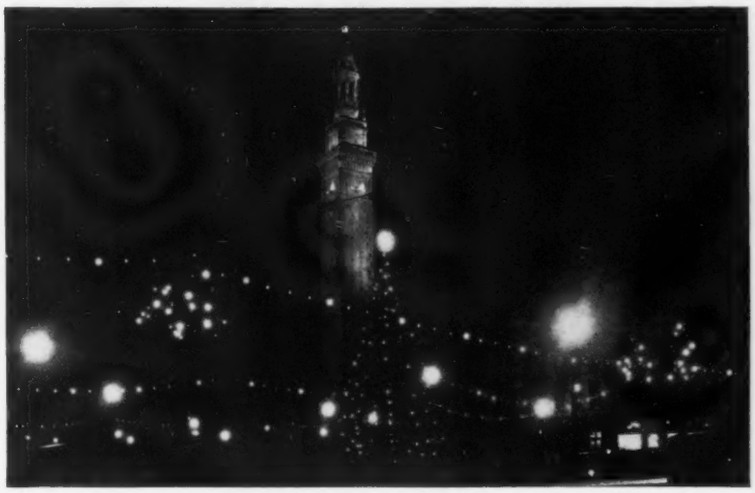

Municipal tower at Christmas Springfield, Mass.

DECEMBER 26, 1931

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Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.
CHICAGO, 520 N. Michigan Ave. 883 Mission St., SAN FRANCISCO Aldwych House, Aldwych, LONDON, W.C.2

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Published weekly. $5 per year. 25 cents per copy. Foreign, $9 U. S. currency, or 45 shillings, per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

CABLE ADDRESS: "MACHINIST, N. Y."

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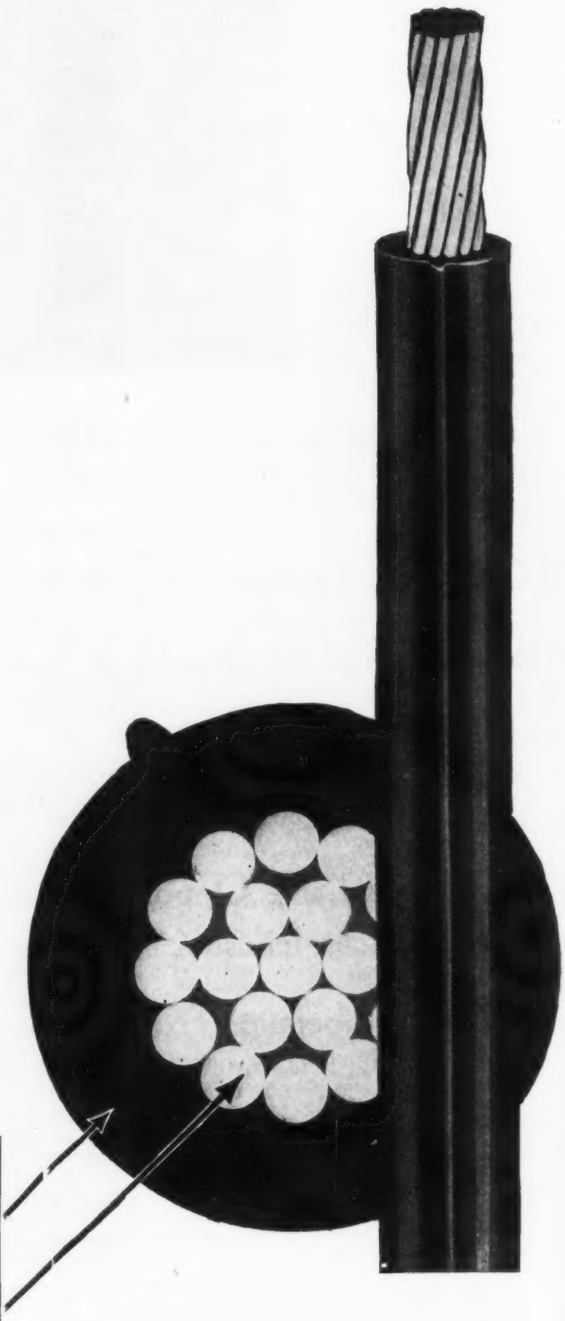

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ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

December 26, 1931

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President
National Broadcasting Company

Zimmermann wants real co-operation

—**John E. Zimmermann of U.G.I.** calls for unity and co-operation by leaders of utility groups. They should "think more about the future of the industry than of themselves" is his plea—*p. 1124.*

—**Indiana merchandising is hit** by decision of Attorney-General that state chain-store tax applies to branch offices of electric light and power companies where appliances are sold—*p. 1114.*

Hudson Avenue station the largest?

—**160,000-kw. units for Brooklyn** raise the installed capacity of Hudson Avenue station to 770,000 kw. Originally planned for eight 50,000-kw. machines, developments in the art show almost two-to-one space saving—*p. 1114.*

—**Russia offers opportunities,** according to Colonel Hugh L. Cooper, builder of the Dnieprostroy, which it is foolish for America to overlook. Are European competitors taking our rightful market?—*p. 1133.*

New base in Pennsylvania rate fight

—**Community opposition urged** by Pinchot as latest weapon to force lower rates. Threat of municipal competition is the implied bludgeon in Pennsylvania Governor's most recent utility-baiting scheme—*p. 1117.*

—**New street-lighting control** in Springfield, Mass., reported upon. Carrier-current design with advanced relaying failed to function in but 95 out of 199,578 operations. Lamps involved total 651—*p. 1130.*

Examiners search for lost $44,000

—**Reading frequency changers** installed outdoors in sheet-steel shelters. Over-all cost reduced 6 per cent, though land area is greater than for comparable indoor design—*p. 1142.*

—**Poor memories and write-ups** feature in this week's news of the Federal Trade Commission investigation. Examiners, unable to decide where $44,000 of Middle West funds went, also explore North American Power & Light finance and policies—*p. 1115.*

Brooklyn Edison Installs 770,000 Kw. in Space Planned for 400,000 Kw.

WHEN the installation of the 160,000-kw. unit (No. 8) in Hudson Avenue station is completed, this plant will have the highest rating of all single generating stations in the world—namely, 770,000 kw.—according to an address made by G. L. Knight, Brooklyn Edison Company, last week. Not only have the cost per kilowatt and the heat economy of this and unit No. 7, a machine of similar size, been a great improvement over those of other units of the station, but the unit cost and B.t.u. per kilowatt-hour have been progressively reduced with each addition since the station was started in 1922. Unit No. 7 is expected to produce 1 kw.-hr. on as little as 10,500 B.t.u.

Although originally planned for eight 50,000-kw. units, the station's fourth unit (installed 1926) was 80,000 kw. and the fifth and sixth units (installed in 1928-1930) were 110,000 kw., making 450,000 kw., or more capacity in six units than was initially planned for the ultimate eight. These increases in unit capacity were accompanied by the use of 400-lb. pressure instead of the original 200 lb.

Installation of units Nos. 7 and 8 required raising the turbine-room floor 5 ft. to accommodate the condensers, installing boilers with 3,650,000 lb. of steaming capacity per hour and adapting bus facilities able to handle the greatly increased concentrations of power. The girders for supporting the new turbines had to be about 6½ ft. deep to limit the deflection to 0.04 in.

The new turbines are tandem-compound units with fifteen stages in the high-pressure element and four stages in the low-pressure element. Provisions are made in the low-pressure end for draining moisture that would cause blade erosion. The blades are made of Ascaloy and have a top speed of 821 miles per hour. The generators are double-circuit units rated at 16,500 volts, and their center lines correspond to those provided for the initially planned units Nos. 7 and 8. To afford space for removal of condenser tubes the generator air coolers are mounted on the turbine floor at the end of the generator and are equipped to use salt water or condensate for cooling.

Condensers of quite different design are being installed under units Nos. 7 and 8, and their performance under virtually identical conditions will be watched with interest, Mr. Knight declared. Each will have 101,000 sq.ft. of condensing surface, but the steam lanes will be arranged in diverse fashions.

Stokers capable of burning 57,000 lb. of coal per hour are installed under the boilers, and their drives will be of the hydraulic type mounted 6 ft. above the floor. Ashes will be discharged into a compartment from which they will be forced by jets into a high-pressure sluicing system. Adjustable-vane fans will be used for both forced and induced drafts to avoid the objection of controlling the discharge outlets. Three-winding motors will drive the induced-draft fans.

Cinder catchers which are more efficient and no more costly than others considered will be used. In general, they are so designed that the gas is directed in a multiplicity of thin sheets perpendicular to the surface of a body of dust-collecting water. This action plus the reversal of direction of the gases on their way to the stack is expected to be particularly effective.

▼

President Gives Congress Muscle Shoals Report

PRESIDENT HOOVER transmitted to Congress on December 17 the report of the Muscle Shoals Commission recommending private as opposed to governmental operation of the Muscle Shoals project and the leasing of the properties under a 50-year contract for the primary purpose of producing commercial fertilizer. The report was abstracted in the ELECTRICAL WORLD for November 28 (page 941).

With the commission's report the President sent a brief special message containing no recommendations but simply reviewing the origin of the commission and its membership. After a series of hearings the commission rendered a unanimous report, which was now presented to Congress for its consideration, the President said. He added that the commission also had prepared a brochure showing the evidence supporting its findings. This, too, the President transmitted "for the information of the Congress."

▼

Indiana Chain-Store Tax Hits Utility Companies

WHEN THE UTILITIES of Indiana two years ago saw the Legislature pass a so-called chain-store tax, they did not expect to be much affected. They suffered a rude awakening December 19, when the State Attorney-General ruled that while utilities as such are not subject to this particular tax, yet if they maintain departments where merchandise of any description is sold a tax will have to be imposed on each such de-

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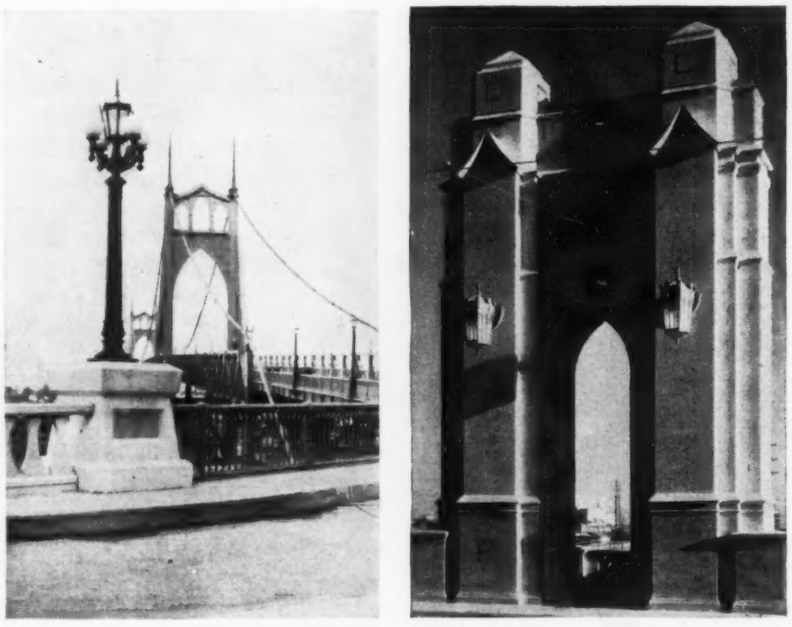
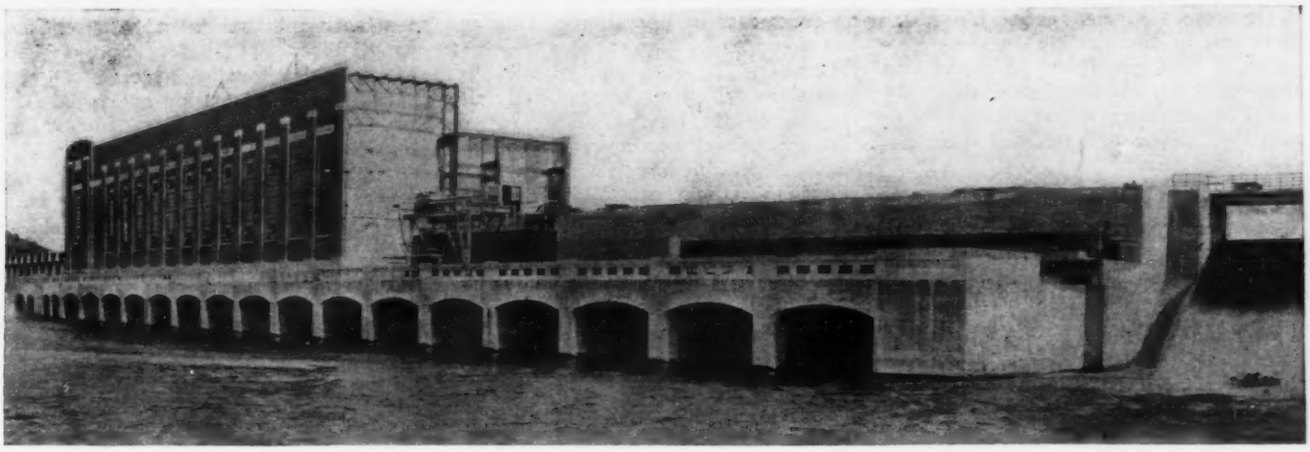
HOW ELECTRICITY LIGHTS THE NEW BRIDGES



Two notable new bridges on the Coast are St. John's, across the Willamette at Portland (left), and the Fourth Street Viaduct in Los Angeles across the Los Angeles River. General Electric luminaires of the types shown above light them artistically.

SLAVE FALLS PROVIDES WELCOME ADDITION TO MANITOBA'S ENERGY SUPPLY



At this new plant of the Winnipeg Hydro-Electric System, on the Winnipeg River, the first two units, now in operation, develop 24,000 hp., and there will be an ultimate capacity of 96,000 hp. Four transmission lines will eventually transmit power to Winnipeg, 86 miles distant. The total length of dams and power-house construction is approximately 3,000 ft.

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partment. It is doubtful whether there is a utility serving any town or city in the state that does not sell appliances, either electric or gas. Systems like the Wabash Valley Electric Company, which serves dozens of towns, with appliance departments in each, will fall into the higher range of taxes, $25 for each such "store."

The manufacturers of such appliances also will be hit, for the ruling states that "agents representing home or foreign concerns having offices and taking orders" will be made to pay the tax, which includes a 50-cent fee for each taxable unit, renewable, with fee, each year. And this is but the beginning. Since the law has been sustained in the United States Supreme Court, it is thought that the next Legislature may increase the tax.

▼

Trade Commission Delves Further Into N.A.L. & P.

FALLIBILITY OF THE human memory was again recorded before the Federal Trade Commission on Thursday, December 17, when Oliver E. McCormick, vice-president and treasurer of the Middle West Utilities Company, and Mrs. McCormick, who before her marriage was assistant treasurer, both testified that they could not recall that they personally indorsed and received currency for bank checks that represented part of the special fund of $44,100 withdrawn under authority of Martin J. Insull in 1926 and of which he, too, said he had no present recollection (ELECTRICAL WORLD, December 12, page 1027). Mr. McCormick admitted that two checks, for $5,200 and $5,000 respectively, bore evidence of having been cashed by him and that it was unusual for him to withdraw cash in this way. He did not know why he did so on this occasion or for what purpose the money was needed, nor could he say to what account the sums were charged. Mrs. McCormick made similar statements concerning checks for $25,000 and $5,000 which the indorsement indicated she had cashed. Saying that it was almost six years ago and that she left the company soon afterward, she told Judge Healy, chief commission counsel: "I don't remember a thing about it."

Getting back to the North American Light & Power Company (ELECTRICAL WORLD, December 19, page 1072), Kenneth A. Miller, commission accountant-examiner, gave several more instances of book values alleged to be inflated. For instance, he testified that the company's ledgers showed an excess book value of $1,066,390 over the cash cost of securities and properties acquired by means of an organization called the Public Utilities Fund set up as a syndicate account when the North American Light & Power was formed. On the previous day Mr. Miller had estimated at $8,000,000 the "write-up" on properties acquired by the North American Light & Power Company (Maine), a separate corporation from the Delaware-incorporated concern of the same name.

Testimony on December 18 included further statements by Mr. Miller concerning financial transactions of the North American Light & Power; a statement by W. D. Gale, assistant treasurer of that company, that specific quantity discounts amounting to $112,000 allowed by the General Electric Company, on system purchases of materials and supplies were not credited to operating companies, although certain other quantity discounts were; a statement by C. L. Studebaker, president of the North American Light & Power, that he personally supplied the company with funds to pay preferred-stock dividends and interest on bonds and was afterward recompensed for so doing by receiving in addition to the money advanced a certain number of preferred shares to make up for high-grade stocks he had sacrificed to raise the funds required, and a statement that Mr. Studebaker authorized the payment of $1,500 to the Washington *Post* for an unsigned advertisement headed "Government in Business" published in a "utility edition." C. N. Wheeler, assistant to Mr. Studebaker, cross-examined by George T. Buckingham on behalf of the company, said that he put in the advertisement "on his own," conferring with no one except Mr. Studebaker and a business representative of the newspaper concerned.

Following Mr. Wheeler's testimony, the commission adjourned subject to call, after expressing appreciation of the co-operation it had received from the North American Light & Power Company.

▼

Ten-Year Iowa Trend from Public to Private Plants

ONE HUNDRED AND FIFTY-NINE Iowa cities and towns which had municipal electric establishments have voted for service from private companies rather than continue their municipal ventures, according to a pamphlet just issued by the Iowa Committee on Public Utility Information at Des Moines, 115 of them during the past ten years. During this period of ten years only six have gone from private to public ownership. Six-

teen voted unanimously to sell. A score more were almost unanimous.

Of these 159, there were 136 which went out of the electric business altogether. The remaining 23 found that they could buy energy cheaper than they could manufacture it and abandoned or sold their plants and retained their distribution systems.

▼

Indiana Rate Agitation Goes on; One Town Out

FIGHTING OVER RATES goes on vigorously in Indiana, with Huntington and Noblesville as recent accessions to the many sizable cities and towns already reported as demanding reductions. In Noblesville a conference between city officials and the Northern Indiana Power Company failed when an accountant employed by the City Council put the city's profit at 27 per cent, while the company insisted that it was scarcely more than 2 per cent. In Indianapolis conferences between the power company, city officials and citizens are proceeding under the auspices of H. K. Cuthbertson, member of the Public Service Commission, in the attempt to reach a rate base by negotiation.

The Martinsville case, of nearly three years' standing, is before a United States court of three members, the Wabash Valley Electric Company holding out for operation of the entire utility system as a unit with rates based on total cost of operation. This case has come to be known as the key to contentions between the utilities and consumers which might completely alter the accepted interpretation of the Shively-Spencer act concerning regulation. Depending on its outcome is the question whether the Insull interests shall be permitted to establish their "south system" for rate regulation; whether certain utilities, including the Insull interests, shall be permitted to assess rates for areas and groups of properties including many towns; whether the commission law giving cities and towns the right to buy local utilities has been abrogated because mergers and consolidations creating larger systems have been permitted, and whether the individual rights of petition, protest and appeal by local communities have been lost because local utility plants have been collected into "systems."

In June of this year Albert Ward, special master in Chancery in the Martinsville case, sustained the commission, which insists that the city is the unit for rate making. The court has now instructed both sides to file briefs, and it is likely a final ruling will not be made for some time. In the meantime the injunction against the rate reduction ordered by the commission will hold. Eventual appeal to the United States Circuit Court of Appeals is probable.

An exception to long-drawn-out strife has just been presented by the city of Hobart. Citizens complained to the Northern Indiana Public Service Company, recent purchaser of the plant there, which readily agreed to lower rates, if the commission approves. The plant will go on the company's high-tension system.

▼

Performance to Govern in Rubber Specifications

STANDARDIZATION OF TEST METHODS and development of performance specifications are likely to supplant the past tendency to put electrical rubber products upon a materials specifications basis. Action of this nature was taken at a recent meeting in New York by the American Society for Testing Materials' committee on insulated wire and cable.

New specifications made for insulation compounds omit reference to the inclusion or exclusion of accelerators and anti-oxidants and place the acceptability solely on the basis of test results. The committee on insulating tapes also made more stringent requirements for test methods and extended them in detail. At the same time, the present weight requirements are removed and minimum yardage per roll is now to be specified. Both the wire and the tape specifications are thereby advanced to the stage of tentative A.S.T.M. standards.

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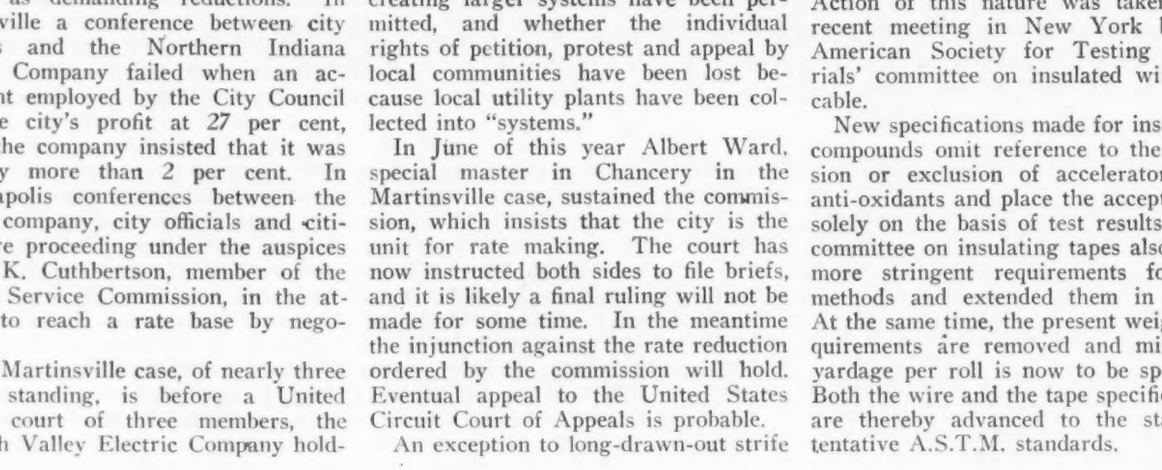
PUBLIC SERVICE ELECTRIC & GAS OF NEW JERSEY KEEPS ON GROWING



—Public Service News

On the left is an addition to the turbine room at Kearny, N. J., to house a new 75,000-kw. steam unit and a 20,000-kw. mercury-vapor machine; on the right an addition at Burlington for an 18,000-kw. unit.

Minneapolis New Rates Give Half Million Saving

ALL CLASSES OF electrical customers in the Minneapolis district will be benefited materially by the voluntary rate reduction previously announced by the Northern States Power Company, of which the details have now been made public by President R. F. Pack. The total annual savings will approximate $500,000, residence customers saving $177,000, small commercial lighting customers $115,000 and other power users $195,000. Street-lighting concessions are also made. The new rates are effective on January 1.

On the standard residence schedule the top step is reduced from 9 cents gross per kilowatt-hour to 8 cents gross or 7.6 cents net. On the optional residence rate an additional discount is allowed. Two steps in the commercial lighting rate are lowered and one in the retail power rates, with a change in the minimum bill. In announcing the changes Mr. Pack said:

"The year 1931 was very dry. This to us meant generation of more electricity in our steam stations and less in our hydro plants, which of course meant large additional expenditures for coal. It is not possible in a business of this kind to reduce materially the number of employees, and there have been no wage reductions. The company has practiced the strictest possible economy during the depression, but even with the savings thereby obtained the practicability of a rate reduction at this time is debatable. However, the benefit of the doubt is given to the customer."

▼

Consumer and Utility Both Cite Fourteenth Amendment

PROF. ALBERT LEVITT of Redding, Conn., appeared before the full bench of the Supreme Court of Errors in that state last week in an effort to obtain a reversal of the Public Utilities Commission's ruling that the Connecticut Light & Power Company was justified in imposing extension charges for electrical energy to supply his Redding residence. He said:

"The company, the commission and the Superior Court have assumed that they can isolate each particular extension of 600 ft., treat it as an extension into new and unoccupied territory and insist that each such 600 ft. must maintain itself and pay a net profit to the company of more than 6 per cent per annum. This is a fallacious position. It is a denial of due process of law."

Professor Levitt insisted that this extension plan makes an unlawful discrimination between those who live in large houses and those who live in small houses and is a direct violation of the Fourteenth Amendment. Counsel for the power company argued that to permit the appellant to refuse to accept the service on the terms approved by the commission and to accede to his demand would entail a loss of $131 a year and would deprive the respondent of its property contrary to the Fourteenth Amendment.

Professor Levitt is taking his fight for lower rates to the Supreme Court of Errors single-handed. He declares that the decision will affect 500,000 people and, if favorable, will save farmers from $5,000,000 to $10,000,000.

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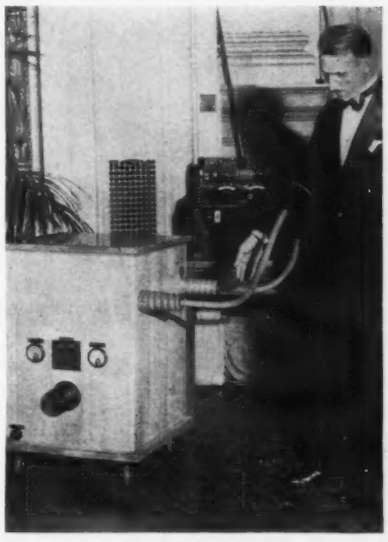
Electrotherapeutic Tools Interest Electrical Club



THREE types of electrical equipment that have recently come into use in the medical field and that give promise of more extensive application were demonstrated before a large audience under the auspices of the New York Electrical Society on December 16. These devices, all portable, were (1) a machine to produce artificial fever, (2) electro-surgical cutting tools, and (3) the electrocardiograph. The applications of the three devices and the results derived from their use were discussed by Drs. C. F. Tenney, Grant E. Ward and Horatio Williams respectively.

The machine built to produce artificial fever, which is called the "radiotherm," utilizes a very high-frequency to raise the temperature of any portion of the body inserted between its electrodes and has been used in treating rheumatic affections. Its application, it was said, may be extended to the fighting of infection. The picture above shows the radiotherm and its constructor, A. B. Page. The surgical cutting tools, which depend on a high-frequency arc to sever and cauterize the tissues, have the advantages of permitting lightness of touch in their use and the prevention of bleeding. The electrocardiograph, depending for its action on the body voltages set up by contraction of muscles, gives a true picture of heart action for the diagnosis of disease.

Dr. G. Failla described the features of the 900,000-volt X-ray developed by Dr. W. D. Coolidge of the General Electric laboratories. One advantage is that the body can be exposed to it for long periods (24 hours a day for two weeks) for treatment of deep-seated troubles not susceptible to short exposures with the customary X-ray process. The tube has been operated up to 850,000 volts, but it has been decided to use it for clinical work at 700,000 volts with a current of 5 milliamperes.

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Pennsylvania Rate Fight Develops New Attack

BACKED BY Governor Pinchot, a movement to organize groups of communities to fight for lower rates from utilities of all kinds is taking form in Pennsylvania. Among the first to enter the field are nineteen municipalities in the western part of the state. Unofficial representatives of these places met in Tarentum on December 16 and organized the Western Pennsylvania Fair Rates Association, designed to be a permanent body. A. B. Davidson, president of the Tarentum Council, was elected chairman.

John M. Walker of Leechburg, Assistant Attorney-General of Pennsylvania, speaking as the Governor's representative, advised his listeners to influence their Senate representatives to ratify the Governor's appointment of two new members of the Public Service Commission who, he said, will represent the consumer. He urged municipal ownership of utilities and said that Aspinwall, Pa., cleared $80,000, nearly its entire budget, last year from earnings of its municipal water and light plants.

More than 300 municipalities in central Pennsylvania, according to Mr Walker, have organized to fight for a cut in present rates of the Pennsylvania Power & Light Company. Similar organizations, he said, are being formed in Cambria, Beaver, Jefferson, Indiana, Erie and Clearfield Counties.

Edward McCloskey, Mayor-elect of Johnstown, declared that he will "go after the utilities hot and heavy" when he takes office on January 1.

A meeting of the association to adopt further plans was set for January 20. The place was not determined.

Pacific G. & E. Loses Two Suits Against State

TWO DECISIONS, both adverse to the Pacific Gas & Electric Company, have been rendered by the Supreme Court of California. In one the court has ruled that a fee of $24,000 which the company paid under protest when it filed a certificate increasing its capital stock from $160,000,000 to $400,000,000 was legally collected by the state and cannot be recovered by the power company. The company had contended that a section of the California political code under which a corporation's fees are graduated according to capitalization is unconstitutional.

The second decision was handed down in a suit brought by the power company for a writ of mandate to compel the Secretary of State of California to accept and file a certificate extending the company's corporate existence to April 10, 1981, for a fee of $5. The court ruled that the company must pay $40,000 if it wished to file the certificate, though the filing is optional with the company. The fee of $40,000 is based upon a rate of $100 for each million dollars of the $400,000,000 capitalization. The company based its contention in the second suit on the same ground as in the first suit, namely, that of unconstitutionality. (ELECTRICAL WORLD, August 22, page 311.)

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Municipal Ownership in Middle West and South

UNIVERSITY CITY, Mo., is considering plans for a city-owned street-lighting system to cost immediately $206,000 and eventually $466,150. A bond issue for $500,000 may be voted on in January. The City Council of St. Charles, in the same state, has ordered a preliminary survey for a municipal light and power plant, which is to cost from $200,000 to $400,000.

A special election is to be held at Marshall, Minn., January 12, on a proposal to sell the municipal light plant to the Northern States Power Company, with a 20-year franchise, for $200,000.

In Milford, Iowa, a proposal to erect a municipal light plant at a cost of $80,000 was carried by 311 to 228.

The Iowa Southern Utilities Company, Centerville, Iowa, has filed an action to restrain the Town Council of Lenox, Iowa, from erecting a municipally owned light plant in accordance with the results of a recent special election.

By 553 to 434 the town of Villisca, Iowa, voted recently for the issuance of $150,000 in bonds with which to erect a municipal electric light plant. The question was voted on several years ago; but no bonds were issued. Villisca is served by the Iowa-Nebraska Light & Power Company.

The Interstate Power Company, Dubuque, has been served with notice by the City Council of Forest City, Iowa, of the city's intention to purchase the local light plant under the terms of its franchise.

Backed by presidents of three prominent manufacturing companies, a suit restraining the city of Piqua, Ohio, from erecting a municipal light plant as authorized by voters at the November election has been filed.

The City Commission of Lima, Ohio, is in disagreement with the Ohio Power Company over rates, and agitation for the erection of a municipal power plant prevails in that city.

A movement is on foot at La Follette, Tenn., for a municipal electric light and power plant, in case the Tennessee Electric Power Company fails to reduce rates and improve service.

The City Commission of Burkburnett, Tex., rescinded an order calling for an election on December 4 to vote on $120,000 of bonds for a municipal light and power plant. Bids for the installation of the plant, however, will be advertised for. Organized opposition to a bond issue by Raymondville, Tex., for the same purpose by a citizens' committee is reported.

Rumors that the Georgia Power Company might purchase the new county-owned hydro-electric plant of the Crisp County Power Commission have been set at rest by J. J. Williams, chairman of the commission, who said that an offer had been received from the company for the purchase of the plant, but denied that it was being seriously considered.

NINETEEN YEARS' ELECTRICAL GROWTH IN RUSSIA

—Soviet Photo Agency

This Russian diagram shows in kilowatt-hours per capita the development of electric power in the Soviet Union from the Tsar's days to the present. Across the top of the diagram is the word "Electrification" in Russian characters.

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Financial Details Aired in San Joaquin Hearings

NOVEMBER HEARINGS into the power rates of the San Joaquin Light & Power Corporation lasted three days and were largely devoted to expenses and revenue and the detailed breakdown of the various items. Among the matters discussed were asserted discrepancies in the prices paid for power from other sources by the San Joaquin Light & Power Corporation, the inclusion in the corporation's operating expenses of $175,000 for a valuation survey and $40,000 to cover the cost of the rate hearing, the total of $215,000 to be distributed over a five-year period; the payment of $3,000 a month for the services of Pacific Gas & Electric Company executives and for legal and engineering services received from that company, of which the San Joaquin company is a subsidiary, and the inclusion in the operating costs of a charge of $25,000 for utility association dues and for 70 club memberships for 43 officials of the company in cities of the San Joaquin Valley and in San Francisco.

Hearings are being continued in December and will go into January.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Washington-Honolulu Telephone

A gap in telephonic communication was closed on Wednesday last when Washington, in the person of Secretary Wilbur of the Department of the Interior, talked with Governor L. M. Judd of Hawaii. Completion of American Telephone & Telegraph Company communications with Hawaii has made this possible. Communication between the two capitals will be by means of wires between Washington and San Francisco and by a short-wave radio channel from the latter city to Honolulu, 2,500 miles distant. There will be no relay on the Pacific Coast. Other radio-telephonic circuits have recently been opened between Washington and Bermuda and Washington and Brazil.

Rates Lower in Washington State

The first of the new uniform rate schedules devised for the Puget Sound Power & Light Company by the Department of Public Works of Washington State will become effective January 1 in all territory served by the company in western Washington except Seattle, and the company was expected also to file its new uniform rates for eastern Washington customers in time for them also to become effective on that date. The company's combined patrons in the two sections will save approximately $250,000 a year. The new rates for western Washington are as follows: First 40 kw.-hr., 5½ cents per-kilowatt-hour; next 110 kw.-hr., 3 cents, and all excess, 2 cents.

Baltimore Goes to 60 Cycles

On December 27 the frequency of the electric current served Baltimore by the Consolidated Gas, Electric Light & Power Company will be reduced from 62½ cycles to the standard 60 cycles. The change, delayed pending other alterations incident to completion of the Safe Harbor project, will facilitate interchange of power, which has been handicapped in the past.

Empire District Electric Rates

Rates in Missouri for the Empire District Electric Company of Joplin are still unsettled. The company's book valuation is about $25,000,000. A two years' engineering audit conducted by the Missouri Public Service Commission resulted in a valuation of only $15,000,000. The Southwest Missouri Rate Payers' Association, organized to take a hand in the dispute, professes to think that even the commission's figures are high.

Wants Valuation Lowered $7,000,000

A scaling down of $7,000,000, or from $32,000,000 to $25,000,000, in the rate-making valuation allowed on the property of the Birmingham Electric Company is asked by J. Q. Smith, former State Attorney-General, in a brief filed before the Alabama Public Service Commission.

No N.F.P.A. February Committee Meeting

Announcement comes from A. R. Small, chairman of the N.F.P.A. electrical committee, that, in deference to a widespread view that this year no necessity exists for the meeting of the committee usually scheduled for the latter half of February, it is the present intention not to hold a meeting at that time and probably not until February, 1933.

Oklahoma Man on Merchandising Law

In discussing the prohibition against selling of appliances by electric and gas companies enforced by the Oklahoma law, H. P. Hoheisel of Oklahoma City, addressing the annual Eastern District conference of the Electric Light and Power Division, Oklahoma Utilities Association, at Sand Springs on December 11, urged fullest co-operation by electric companies with dealers in appliances. Restoration of merchandising business to the utilities, he said, depends on their willingness to carry on educational and promotional work with both organized effort and sufficient funds. He thought it was not economically possible for this work to be done by ordinary appliance dealers. The same point of view was emphasized at the Western District conference held at El Reno the next week.

Is Steam-Heating Service Utility Job?

A rule of the Union Electric Light & Power Company of St. Louis that its steam-heating service will be supplied only to light and power customers has been attacked before the Missouri Public Service Commission by a former electrical customer of the Laclede Power & Light Company—the Missouri Bag Company—which says that it was forced to abandon its contract with the Laclede company in order to obtain steam heat from its competitor. The commission must decide whether steam-heat service is a utility function and discrimination in supplying it is consequently forbidden.

Los Angeles Would Buy Edison Lines

Request that the Southern California Edison Company sell to the city of Los Angeles its electrical distributing system in territories annexed to the city since 1922 has been made by the Board of Water and Power Commissioners in the form of a resolution adopted by the board. The price to be paid would be fixed by the California Railroad Commission. There are 37 districts in the territory annexed to the city since 1922.

CANADA

Consolidation of Quebec Power Company

Over the last eighteen months the Quebec Power Company has been steadily working on a program of consolidation. In June, 1930, the charters of five of its subsidiary companies were surrendered and assets of these concerns absorbed into the parent company. The final step in the consolidation is seen in an action taken by the company to have the provincial government determine its charter powers and at the same time give it the right to purchase the Quebec Railway, Light & Power Company. The company just named operates a 5,600-hp. water-power plant at Montmorency Falls.

Montreal May Discontinue Arc Lamps

Montreal is considering the expenditure of $1,000,000 to substitute incandescent street lamps for the existing arcs. The proposal would mean also a change from direct current to alternating current for the incandescents. The city would use lamps ranging from 250 cp. to 1,500 cp. Plans are to commence the new system in the outlying sections, working toward the center and meet the underground-conduit system as it spreads from the center outward.

ABROAD

Brazil to Spend Millions to Electrify

Electrification of a portion of the government-owned Brazilian Central Railway, at a cost of about $50,000,000, is under contemplation, and the Brazilian government is open for tenders. The project covers suburban lines around Rio de Janeiro as well as a 70-mile stretch of the main line. Two large waterfalls owned by the federal government, Salta and Mambucaba, are to be harnessed to provide the energy, according to Brazilian officials. The Brazilian Central Railway operates 1,500 miles of line, and it is the intention of the government in time to electrify the whole system.

Coming Meetings

American Engineering Council—Washington, Jan. 14-16. L. W. Wallace, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 25-29; district meeting, Milwaukee, March 14-16. F. R. Hutchinson, 33 West 39th St., New York.

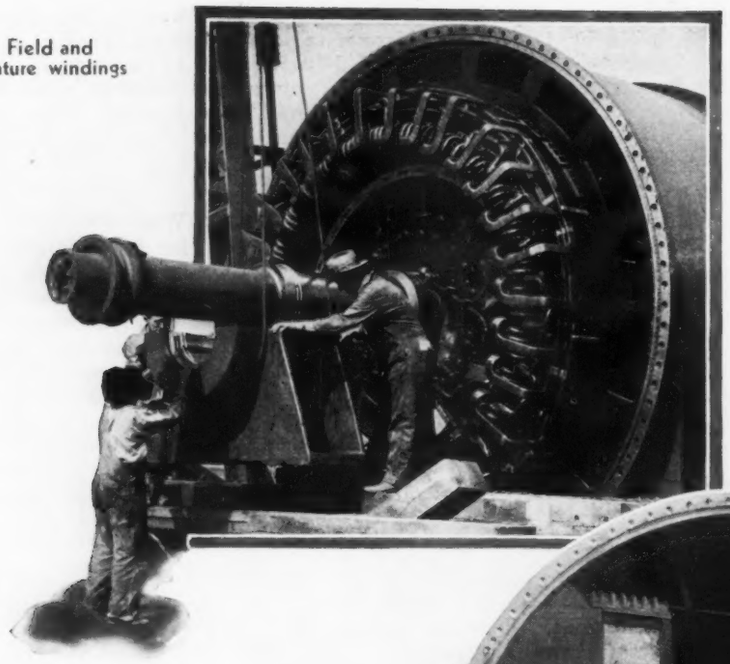
Conference of Electrical Leagues—Philadelphia, Jan. 25-27. Society for Electrical Development, 420 Lexington Ave., New York.

North Central Electric Association—Commercial Section, Lowry Hotel, St. Paul, Jan. 29 and 30; Engineering Section, St. Paul Hotel, St. Paul, Feb. 22 and 23. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

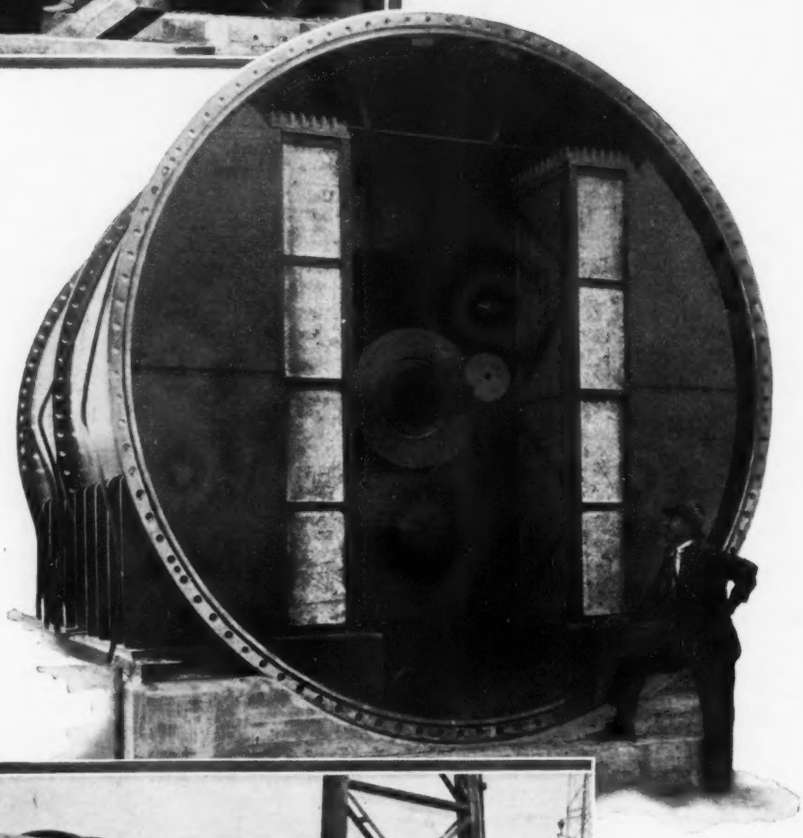
National Electric Light Association—Group committee meetings: Engineering National Section, New York, Feb. 1-5; Accounting National Section, Statler Hotel, St. Louis, Feb. 15-17. A. J. Marshall, 420 Lexington Ave., New York.

Oklahoma Utilities Association—Tulsa, Okla., March 8 and 9. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

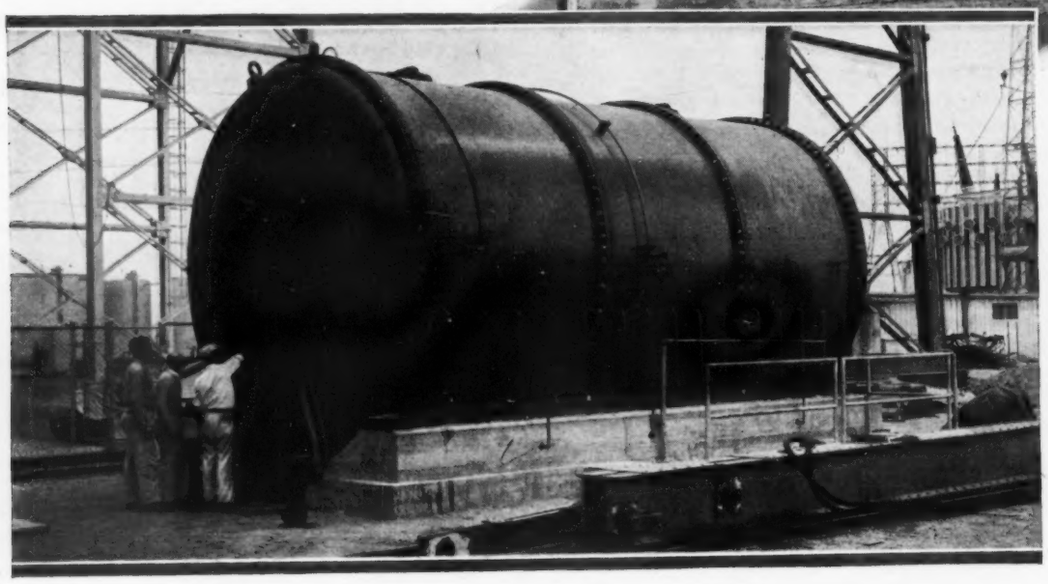
Hydrogen-Cooled, 50,000-Kva. Outdoor Condenser



Field and armature windings



Recently the Southern California Edison Company, Ltd., completed the installation of the automatically controlled 50,000-kva., outdoor-type, hydrogen - cooled synchronous condenser here shown at its 220/66-kv., 150,000-kva. La Fresa substation near Los Angeles. The condenser is said to be largest of its type yet built. A second unit of similar design and size is to be installed later.



Water coolers through which hydrogen gas is circulated.

Condenser in its gas-tight shell.

EDITORIALS

L.W.W.MORROW
Editor

Christmas

THIS is the time to gather together in gladness for giving and receiving. It is the annual occasion on which kindness rules the hearts of men and knits together the just and the unjust to perform deeds of helpfulness without hope of reward. This feeling of good will spreads into all human relationships and carries the perfume of its actions in coming days. Never was Christmas more welcome or more needed to bring recognition of the essentials of life.

This year we celebrate good will and kindness so that peace and plenty may return. Life is measured more by feeling than by thought, and the lowest and the highest in the scale of riches participate in the concord of humanity so needed in periods of adversity. Perhaps this cessation of activity and this merger of action with feeling may serve as a stimulus for better days to come. Like a benediction it may bring something that elevates and inspires the drudgery of earth. Out of the heart may come impulses to direct thought and dower action to bring confidence and victory to hard-pressed mankind. Merry Christmas has a vivid meaning and a new promise in this year of depression.

Facts force industry sales

NO ONE can have much confidence in predictions about general business conditions for 1932. All facts and opinions lead only to guesses as to movements up or down or on the existing level. Practical business judgment, however, bespeaks the formulation of programs based upon a continuation of the conditions of 1931—if improvements occur, so much the greater will be the acclaim accorded them. The counsel of courage is to be optimistic and yet to fight with the greatest possible intelligence and strength. Those who expect no improvement and make no fight to get improvement will not be disappointed, for no gains appear possible except through aggressive and intelligent action.

In the electrical industry there is ample opportunity for increased business. The markets are still unsaturated for industry products and services. Instead of 580 kw.-hr. per home, the figure should be 8,000. Instead of a 10 or 15 per cent appliance saturation in homes, the percentage should be 70 or 80. This home market is a billion-dollar market for utilities, for appliance manufacturers and for makers of wiring supplies. The million refrigerators sold in 1931 should be duplicated with million-unit sales of each household appliance in 1932. Nor is the industrial market saturated. There is a power load available at least 35 per cent greater than that now supplied. In addition, the use of electric heat and electric processes in industry affords a business of equal magnitude for the sale of both energy and manufactured products. Besides this, the lighting business is not developed to more than 50 per cent of its possibilities.

But this new business must be sold. Salesmen must replace order takers, and utility and manufacturing executives will have to make rates and products that are competitive and meet the requirements of these markets. No longer will normal national growth and self-selling services and products sustain business or increase business. Conditions exist that require new and different treatments; but if the industry will meet the situation, it can very greatly increase its own business, even though the general level of business activity in this country remains at present levels. The acquisition of this business profitably and intelligently is the major problem of the industry and its major opportunity.

Regulation for competition

NEAR-SIGHTEDNESS and clear long-range vision characterize two diametrically different decisions affecting local competition with established utilities. New York City's Board of Estimate, mindful of the pending appeal against the Edison companies' rates, authorizes a real-estate corporation to lay conduits in city streets to serve its tenants and others in direct competition with the utility. The twenty-five-year renewable franchise affords the city a franchise fee rising to 5 per cent of gross receipts and has provisions identical with others granting the use of the streets. Will the state's Public Service Commission grant the requisite certificate of convenience and necessity in the face of the Edison companies' objection, or will it be guided by the same sane principles which the Indiana commission enunciated in acting adversely on a somewhat similar proposal?

Indiana has a law which encourages municipalities to acquire by condemnation for public ownership utility facilities wherever the major portion of the utility property used and useful for serving that municipality lies within the corporate limits of the community. The commission turned down North Manchester's request because the distribution system within that municipality is only a small part of a comprehensive system fed by centralized generating plants.

The salient point is that the majority of the Indiana commission do not rest solely on this technicality of the law. Utility regulation, in their opinion, constitutes a code of action which must have a definite objective and must move in a specific direction. Oscillation and vacillation are foreign to the best interests of the state and its citizens in their capacity of consumers, employees and investors. To foster on one day the integration of highly efficient and economical utility power systems and on another day destroy the value and usefulness of those systems by sanctioning whimsical municipal competition is beneath the intellect of any board with the sound interest of the community at heart. This particular board has the courage to say that Indiana would slide twenty years backward if such a program should be allowed to engulf the whole state. It is also sad but true that it would probably take another twenty years for the people to learn how much they would meanwhile have sacrificed by placing their offerings on the intriguing altar of socialization.

It will be interesting to see whether Governor Roosevelt's commission will have the stamina to thwart Mayor Walker's board on the same ground of utter public inexpediency that fortified Indiana's commission in arriving at such an equitable and courageous answer.

This year's opportunity for financial statements

THE power industry will do itself a lot of good or a lot of harm within the next few weeks according to the way in which it presents its annual statements to the public. It becomes more important this year than ever before that the meaning of these statements be made clear because of the marked contrast between the nearly normal volume of business done by the average power company and the smaller percentage of normal volume that the average manufacturer or other business man will see on his own statement.

There is nothing in this for the power industry to hide or be ashamed of. For it is, in fact, a measure of the public service rendered by these utility companies that in this year of bad business the total sales of the entire industry should be off but something like four per cent. The fact that, despite the reduced consumption of power in factories, this total volume for the year remains so large would be astonishing to electrical men themselves if they did not know the reason so well. But the public does not know. People will not understand that, because times have been hard, men and women in the twenty-three million homes now using electricity for light and other comforts have been staying home in the evenings in order to economize and therefore have been actually consuming more energy. Yet, what a vital service to the country, in this emergency, to have provided so many people with something in their homes that they desired so greatly!

For several years some public utility companies and other corporations have issued interpreted annual statements that explain each item in the balance sheet. This year they should go still further if possible. They should tell the whole story.

Making friends with minority stockholders

BEFORE a public utility merger can be completed on the basis of a 100 per cent common stock deposit it is obvious that the minority stock interest must become nil. So long as any "irreconcilables" refrain from exchanging their shares with the controlling organization or refuse to sell out their holdings the elements exist from which trouble may at some time or other develop, and the situation remains to some degree unsatisfactory. Legal requirements and clerical inconveniences are often annoying and costly in such cases, but the major disadvantage lies in the existence of a body of opinion on company affairs which is out of line with, if not actively hostile to, majority policies. For such reasons much hard work is done every year in the power industry to persuade minority stockholders either to sell their equities or to join hands with the majority; but as long as human nature remains what it is success is likely to be more lastingly achieved by untiring and patient friendliness than by "strong-arm" methods.

It ought not to be necessary to state that the minority stockholder is at all times entitled to fair treatment. His very independence of the majority makes him a relatively larger factor in public relations within his zone of personal influence than the ordinary shareholder. The policy of trying to pry him loose from his holdings by suspending dividends on outstanding minority stock, by unsecured loans or any other pressure except honest persuasion is open to severe criticism. If the minority stockholder is determined to block unanimous stock transfer on account of some grudge against the interests involved in the merger, let the reason for his action be discovered and if possible eliminated. If he is out to exact the highest possible price for his holdings, it may pay to let him wait a long time before meeting his figure. The conditions surrounding every merger will furnish a satisfactory guide here; but the most scrupulous fairness of treatment should be accorded him, no matter how exasperating his stand. Not seldom it will appear that some far-removed experience with a company employee, some adverse decision on costs of service or some misapprehension of the policies of the new régime lies at the bottom of minority "obstreperousness." Consistent efforts to eliminate all reasonable grievances and to play the square game will go a long way toward attaining the final objective sought.

Metals hardened by rotary electromagnetization

ONCE men used to hammer and bruise metals to harden them. Then came heat and quenching. Electric heat lately has afforded the requisite refinement of control to catch the temperamental molecular structure at its critical stages. Now comes electromagnetic processing to superimpose the niceties of superhardening and stabilization by penetrating the atom itself in the process of molecular readjustment. Interesting results obtained by Edward G. Herbert have been reported by him in recent proceedings of the Royal Society.

The theory advanced is that hardness and resistance to deformation generally are matters of molecular cohesion and configuration. Any cyclic wabbling of atoms and molecules can be gambled upon to bring them through phases which will at times be more favorable to the establishment of the cohesive foundations for hardness properties than at other times. The cycles are hours long as disclosed by experiments and can only be accounted for on the basis of precessional behavior. The precession of the gyroscope is a long cycle by comparison with its very short rotational period at high speed. The gyroscope's period can be shortened by increased gravitational torque, and so can the hardening cycle in the case of metal molecules be shortened by increasing the precessional magnetic torque on its electronic orbital axes.

Simply, it appears to be a case of inverting the process of making a magnet out of hardened steel. In this instance the steel is superhardened by rotary magnetization, which merely jiggles the atoms into closer cohesional affection. If supplementing the bombardment, quenching and annealing processes by electromagnetic reorientation of the molecules will raise steel, brass and even duralumin to greater heights on the hardness scale, then electricity has revealed just one more of the potentialities it holds in store for useful exploitation.

U. G. I. Head Comments on Industry Criticism

J. E. Zimmermann
President
United Gas
Improvement Company

NOTWITHSTANDING the remarkable record of performance of utilities, criticism is directed at the relations of the electric industry as a whole to society collectively. "It will not do lightly to dismiss these charges as unfounded or as emanating from politicians and some of the newspapers," warned J. E. Zimmermann, president of the United Gas Improvement Company, at a meeting in Philadelphia recently. "The fact that they gain support from men in public life and from the press demands that they be seriously considered.

"It is inevitable, in an industry which has expanded so rapidly and which has been called upon to solve so many new and difficult problems in finance, engineering and management, that mistakes have been made, unsound financial practices followed in some instances and unwise managerial policies put into effect in others. It does not seem to me, however, that anything constructive will be accomplished by destroying the industry for the sake of punishing a few.

"Instead of criticising the industry as a whole, the effective way to correct abuses which may exist is for the public to exercise a discriminating judgment between those companies and groups of companies whose properties are conservatively financed and managed in conformity with the best business standards of the day and that relatively small number of companies or groups whose unsound financial or managerial policies and practices have brought discredit upon the industry as a whole."

Considering the perplexing subject of valuation, Mr. Zimmermann said:

"Students of the subject agree that it is highly desirable to reach a stable basis of valuation and thus avoid the interminable controversies between the advocates of one or another of the methods of determining values. The difficulty, which seems almost insuperable, is to find a formula which will stand the tests of the courts. A solution must be found, however, as the most serious aspect of the present rule for fixing the rate base is the uncertainty that this involves."

On the subject of commission regulation he said:

"The interests of the public and public utilities are always best served by effective state regulation and any well-considered measures calculated to strengthen the confidence of the public in such regulation should receive the cordial support and co-operation of the electric industry.

"State commissions now possess the power to protect the public against unreasonable rates being charged and collected on power transported from one state to another. If it should be determined that they are unable to enforce this control, then there are better ways of solving this question than by injecting the federal government, with all that this implies in the way of more commissions, more bureaus and more taxation."

To meet the criticism of lack of frankness in financial statements, Mr. Zimmermann declared:

"Public utilities should issue at frequent intervals full statements of their earnings in sufficient detail to give their stockholders a thorough understanding of the affairs of the company and the public in general a proper comprehension of their operations. Any reasonable regulation necessary to bring this about should be welcome."

Referring to the rapid standardization of engineering, accounting and merchandising pratices of operating companies, to permit intelligent comparisons, he said:

"It would be very helpful to the investing public and for a better understanding of their affairs by the public if there could be the same uniformity in the policies and practices of holding companies, so far as their relations with their subsidiaries are concerned, of such matters as management charges, financing, purchasing, bookkeeping practices and construction activities.

"All contracts between holding companies and their operating companies for financing, purchasing, and construction should be open to the inspection of commissions at all times, and, if necessary in order to remove the criticism of unreasonableness and unfairness, should be subject to commission approval.

"The same intensive study must be given to coordinating and clarifying holding company relations with the public, with their subsidiaries and other holding companies, as has been given for many years toward standardizing the practices of operating companies.

"It is the inability of the leaders of the public utility groups to agree upon a common policy with reference to controversial subjects that has subjected the industry to some of the attacks from which it is now forced to defend itself. The harmonizing of the views of the leaders of these groups on public questions has in the past proved impossible and in the nature of things will continue to be extremely difficult in the future, but I venture to say not impossible if the leaders of the industry will think more about the future of the industry than of themselves."

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Ontario Hydro Experience with 220-Kv. Operation

Something like 1,000 mile-years of operating experience with 220-kv. transmission* has been had by the Hydro-Electric Power Commission of Ontario and during this period sixteen line interruptions have occurred. According to Edgar T. J. Brandon, electrical engineer of the commission, these interruptions may be classified as follows:

Cause	No. of Interruptions	Average per 100 Miles per Year
Lightning	10	1.0
All other causes	6	0.6
All causes	16	1.6

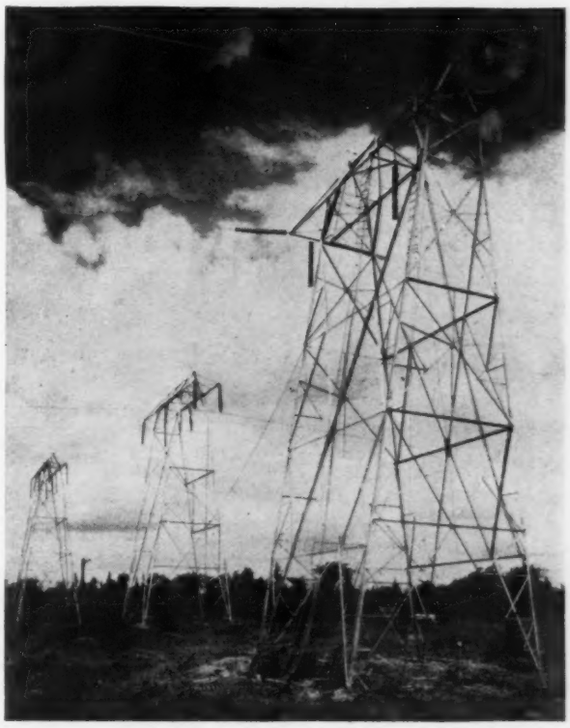
From August, 1929, to September, 1930, no automatic operation due to any cause was recorded.

Except for the period when only one circuit was in operation, only one interruption has resulted in a failure of the 220-kv. supply (this being apparently due to the failure of a circuit breaker to open), all others affecting one circuit only. Line flashovers with one exception have been cleared without permanent damage to conductor and, in all but a few minor cases, without the shattering of insulators. Grading rings are not installed on these lines. Damage due to lightning flashover has been so small that not more than 50 per cent of the points of flashover have as yet been located.

Lightning flashovers have been divided, 60 per cent involving only one conductor, 30 per cent two conductors and 10 per cent (one case only) apparently (from relay records) involving all three. No case is recorded of simultaneous flashover on two circuits (circuit spacing 100 to 150 ft.), though one case is recorded when flashovers apparently occurred simultaneously on two different phases of the same circuit at points about 3 miles apart. Flashovers involving two phases and ground have not to date caused any tendency to instability.

Due to the difficulty in locating the points of lightning flashover, definite statements cannot be made, declares Mr. Brandon, but, based on relay and automatic oscillograph records, he expresses the opinion that the majority of flashovers are occurring in the district where tower footing resistances are known to be generally of the order of 250 ohms. Steps are now being taken to reduce these resistances by the use of buried conductors.

Elimination of vibration troubles has been the chief concern of the commission so far as these 220-kv. lines



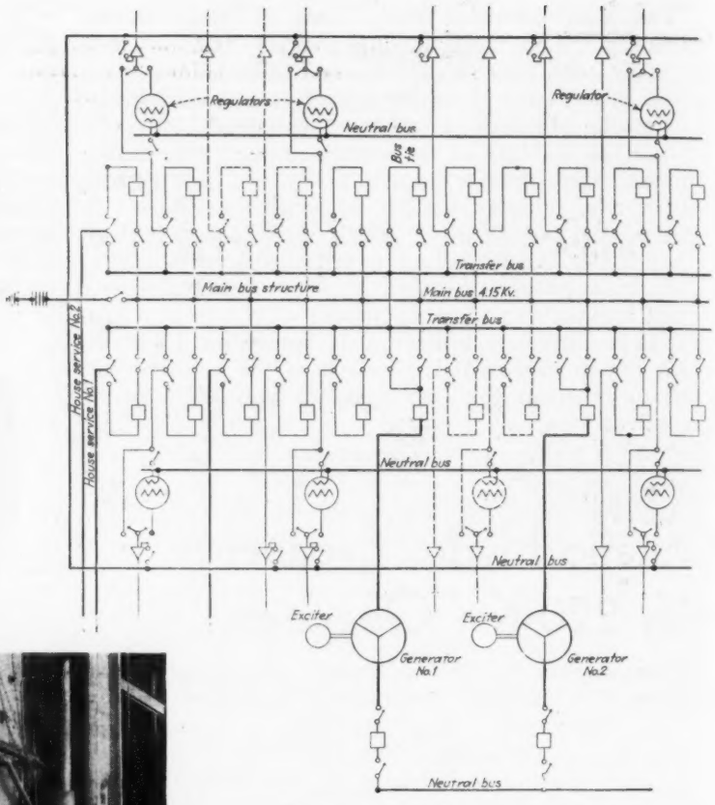
Typical 220-kv. line of Ontario Hydro Commission

are involved. The first two circuits were equipped in part with the two types of absorbers described in Mr. Brandon's recent Institute paper; some sections were installed without protection of any sort. The third circuit is being equipped with the Aluminum Company's tapered aluminum rods. With this variety, the commission expects to obtain experience regarding the efficacy of these devices. Inspections have revealed no actual strand failures up to this time.

One interesting change has been made in construction methods. Previously, footings were set by means of a template by footing gangs working some distance ahead of the tower erection gangs. On the third circuit the footing and tower erection gangs have been combined. Footings are excavated and the grillages placed, and then tower erection is carried out on the open footings. The first section of the tower becomes the template and the complete tower is erected before final leveling is carried out and the footing backfilled. This method has been found to speed up the tower erection, generally eliminating the difficulties which occasionally arise in fitting the tower to footings set days or weeks earlier.

The first circuit has been operating since October, 1928; one-half of the second circuit since October, 1929, and the complete circuit since July, 1930. The third circuit went into service the first part of October, 1931.

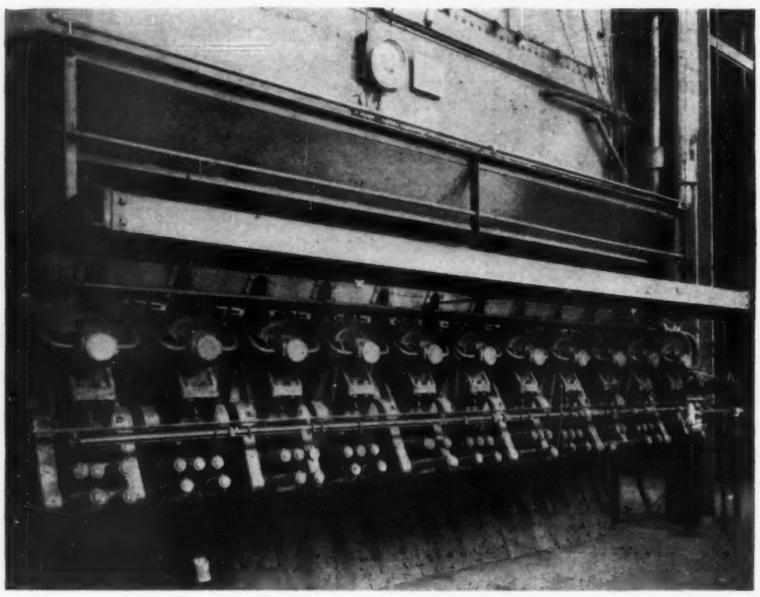
Modern Design, Medium-Sized Station



Flexible switching is provided

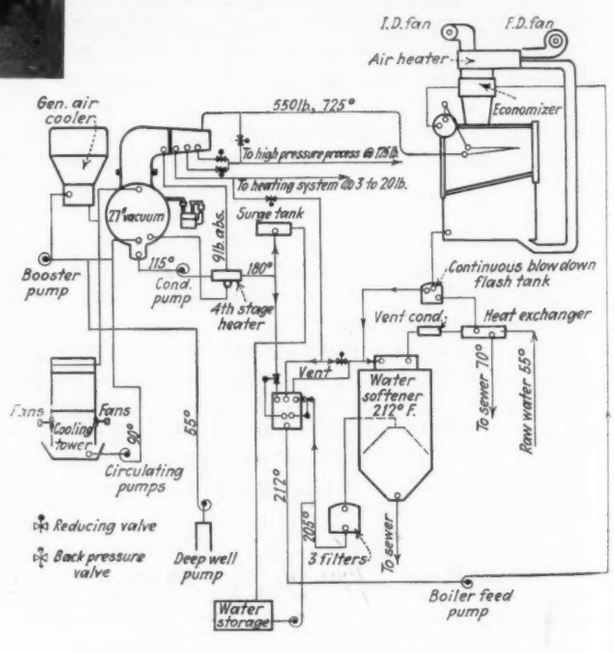
The main and transfer bus arrangement is used not only for generators and outgoing feeders but for the 4,150- and 460-volt house service as well.

Each stoker ram operated by hydraulic unit



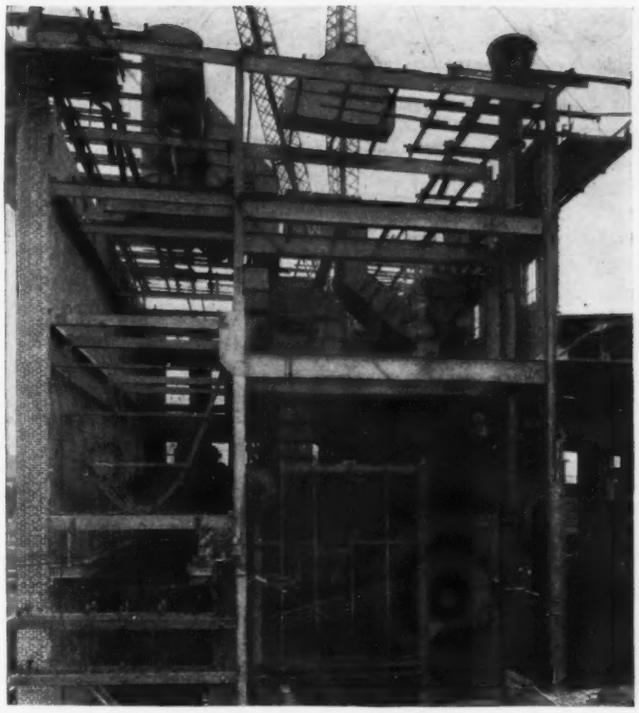
Bled steam supplies creamery and district heating

Steam is bled from turbine at 125 lb. to supply adjacent creamery at 3 to 20 lb. for district heating and at 4 to 14 lb. (absolute) for feedwater heating.

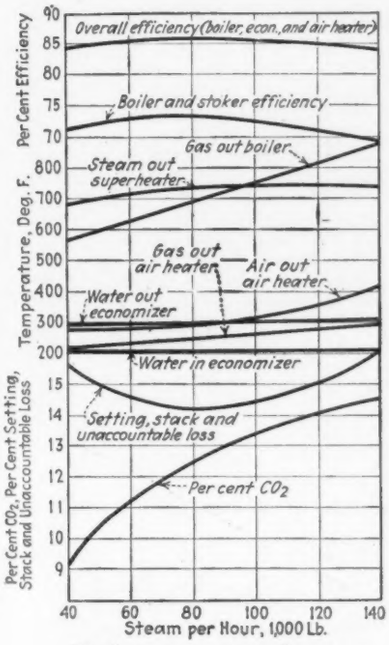


PRACTICALLY every modern development for economy in a steam plant is incorporated in the design of the new Lincoln, Neb., station of the Iowa-Nebraska Light & Power Engineering & Construction Company. The station was arranged for special conditions which include the sale of bled steam at 125 lb. gage to an adjacent creamery with a peak demand of 10,000 lb. per hour, bled steam at 20 lb. gage for district heating system with a peak demand of 120,000 lb. per hour, treatment of make-up water due to non-return of condensate to remove approximately twelve grains per gallon of scale-forming materials; the absence of an abundant supply of condensing water which made it necessary to use a cooling tower with make-up water taken from a salt well with a concentration of 2,000 grains per gallon and, finally, a limited ground area on which to construct the plant.

In addition to providing for these special conditions,



Compact boiler house


Overall efficiency (boiler, econ., and air heater)
Boiler and stoker efficiency
Gas out boiler
Steam out superheater
Gas out air heater
Air out air heater
Water out economizer
Water in economizer
Setting, stack and unaccountable loss
Per cent CO_2
Per Cent Efficiency
Temperature, Deg. F.
Per Cent CO_2, Per Cent Setting, Stack and Unaccountable Loss
Steam per Hour, 1,000 Lb.

Performance at various steaming capacities

the station design includes water-cooled furnaces, economizers, air-preheater and means for coal or natural gas firing with oil standby. The station has a present rating of 13,600 kw. (ultimate 19,500 kw.) and cost $110 per kilowatt.

The station operates in a 2,300-mile transmission system of 51,000 kw. generating capacity, 17,000 kw. of which, including this plant, is of modern high-economy steam design. There is 2,000 kw. in Diesel engines and the remainder is in older steam stations and hydro plants scattered over a large system area in western Iowa and eastern Nebraska. The new Lincoln station will operate as base-load plant with a high load factor.

The base-load condition, combined with boiler equipment designed for an economy of 86 per cent in connection with the bleeder-type turbine, is expected to result in an average B.t.u. per gross kw.-hr. generated in the neighborhood of 17,000 when bleeding for the creamery only, during summer periods, and 15,500 when bleeding for the heating system and creamery during the winter period.

Investment cost was held down largely by close attention to building design and arrangement of equipment into a compact layout, which makes the fullest utilization of building space. Building steel was used for the support of the overhead coal bunker, steel stack, air heaters and economizers. The erection of equipment and building were carried on in a progressive manner. These features are apparent from the plant cross-section.

▼

Eyesight Conservation in the Home

By M. LUCKIESH,
Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio

Improved residence lighting has such inherent possibilities for conserving vision that it might be said that "conservation of vision begins at home." In the home visual tasks such as reading and studying are quite as severe as those encountered in the work-world. In addition, they are usually performed in the evening when the eyes have been fatigued by the day's work. Defective vision often begins in early childhood and lighting should be utilized to give the maximum assistance in reducing ocular strain and fatigue of young and easily injured eyes. The following data indicate the time spent in home reading by the "average family":

	Relative Number of Persons	Hours Spent in Reading	Total Daily Person-Hours
School children	1.0	1.5	1.5
Adults	3.2	0.5	1.6

That school children average 1½ hours daily in reading by artificial light in the home and that 22 per cent of them have defective vision may be regarded as significant and related facts. That good lighting is of known benefit to the eyes and that there are 20,000,000 such families now supplied with electric current for lighting purposes are indications that there is something in eyesight conservation.

While esthetic considerations govern the method of lighting the home in general, visual efficiency should be the object of lighting of certain places where exacting visual work is done. Clear seeing, visual comfort and the conservation of eyesight are important factors to the occupants of the home and should be given definite consideration. The attainment of these visual benefits demands, as in the work-world, higher levels of illumination. The portable lamps, used almost universally in lighting, for reading and close visual work, provide a ready-made field for carrying out the conservation of vision program. Higher-wattage lamps and multiple-lamp portables can be recommended to increase the level of illumination.

It is to be expected that an individual, accustomed to excellent lighting for seeing in his home, will appreciate more keenly the deficiencies of lighting elsewhere. The program of conservation of vision can be emphasized in the home with much indirect as well as direct benefit.

Can Losses Be Reduced?

Dollars involved in unaccounted-for kilowatt-hours are dollars irretrievably lost. That these wastes are not in any sense inconsiderable can be seen from the 12,000,000,000 kw.-hr. of unaccounted-for energy in 1930. Inasmuch as the corresponding grand total of generated energy was 83,000,000,000, the national loss figure is some 14.5 per cent. The monetary value attached to these unsold energy units can be set at $200,000,000. Here is a prolific source of operating charges which hold out possibilities of transfer to the income column.

Let no one get the idea that the problem is so simple that at any moment the power industry may awaken to its blind negligence and henceforth proceed to increase its salable product by one-seventh without increasing production and production costs. Certain losses in generation, transmission, conversion and distribution are inevitable and will remain so until zero-resistance conductors and zero-loss magnetic iron are produced at low cost. Iron has made some progress, but copper and aluminum still take the same inherent toll of I^2R in kilowatts and kilowatt-hours. Conquering the obstinate properties of materials is a slow process of attrition. But conquering the inertia of mental process that follows contentment with the *status quo* is an easier task, with prompter benefits from the results.

Energy costs have changed, copper has changed in price and investment costs are on a new plane. These three are the elements which determine the economic balance, which in turn fixes the most appropriate value of loss to condone—more would waste annual dollars to save investment dollars, less would entail too many equipment dollars in an effort to save operating dollars. Load factors have changed, the industrial in the unfavorable direction and residential in the favorable direction, without pronounced effect on the over-all load curves. Load curves on specific lines and pieces of equipment under intelligent handling of interconnected systems can be quite good. Maybe they could be better, without endangering stability, disrupting operating régimes or taxing the service lives of equipment.

Wherever that is possible it would justify more invested dollars to reduce losses of cheaper kilowatt-hours in cheaper copper. Here and there the economies in investment may be great enough to justify the same investment dollars, getting more conductivity at the lowest price and thus retrieving lost kilowatt-hours for sale purposes. In any event, the new absolute and relative values of the determining quantities point to the virtue of analyzing afresh the proper proportions of waste energy and equipment and conductor dollars to conserve the kilowatt-hours. This is especially true in connection with new construction and changes in system operating technique.

The tabulation shows that the 68 transmission type companies which generated 52,777,000,000 kw.-hr. sustained unaccounted for losses of 8,230,320,000, amounting to 15.6 per cent. On the other hand, 41 metropolitan companies had a 14.5 per cent loss (12,030,070,000 kw.-hr.) out of their generated total of 82,220,000,000. It might be expected that the extensive systems would show a somewhat higher loss ratio than those serving compact urban areas. The difference is not great, however.

Real differences exist between systems within the same classification. For example, the extremes for metropolitan companies are 5.3 per cent and 22.5 per cent. While local load characteristics will undoubtedly account for much of this difference under present operating conditions, there is reason to believe that there could well be less deviation from the average. Likewise in the transmission group the range is from 7.3 to 29.0 per cent. In both instances the first point of attack is in the accounting method, in so far as it permits odd items to accumulate in the unaccounted-for column. Next is the method of estimating quantities for which no metered values are available. Then the point of attack

Table I—Losses for Typical Transmission Companies

New England Power Association	14.1	Georgia Power Co.	19.8
Connecticut Electric Service Co.	13.8	Carolina Power & Light Co.	21.3
Western Massachusetts Co.'s	14.4	Virginia Electric & Power Co.	13.8
Central Maine Power Co.	17.0	Alabama Power Co.	15.0
Blackstone Valley Gas & Elec.	12.6	Florida Power & Light Co.	22.2
Public Service of New Hampshire	14.0	Virginia Public Service	17.6
Cumberland County Power & Light Co.	14.9	Tennessee Electric Power Co.	20.2
Niagara-Hudson Corp.	10.5	Kentucky Utility Co.	13.1
West Penn Electric Co.	12.8	Mississippi Power & Light Co.	23.7
Public Service of N. J.	14.3	Mississippi Power Co.	18.6
Penna. Power & Light Co.	14.0	Tennessee Public Service Co.	9.7
N. Y. State Gas & Elec. Co.	13.2	Oklahoma G. & E. Co.	14.8
Westchester Lighting Co.	17.8	Texas Electric Service Co.	12.3
Penn. Central Lt. & Power Co.	14.5	Texas Power & Light Co.	*18.3
Long Island Lighting Co.	23.5	Arkansas Power & Light Co.	20.1
Ohio Power Co.	7.6	Gulf States Utilities	14.6
Public Service Co. of Northern Illinois	11.0	Central Power & Light Co.	22.1
Columbia Gas & Electric Co.	10.0	Public Service Co. of Oklahoma	13.3
Consumers Power Co.	18.0	West Texas Utilities	17.4
Ohio Public Service Co.	9.3	Southwestern Gas & Electric Co	13.1
Illinois Power & Light Co.	18.0	Montana Power Co.	13.4
Indiana & Michigan Elec. Co.	7.3	Utah Power & Light	16.1
Central Illinois Public Serv. Co.	18.1	Idaho Power Co.	12.6
Wisconsin Power & Light Co.	14.3	Public Service Co. of Colorado	19.4
Wisconsin Public Service Co.	13.8	Pacific Gas & Electric Co.	26.4
Interstate Public Service Co.	18.6	So. California Edison Co.	17.4
Northern States Power Co.	17.1	Puget Sound Power & Light Co.	20.4
Minn. Power & Light Co.	15.9	Washington Water Power Co.	20.7
Kansas Gas & Electric Co.	15.6	California-Oregon Power Co.	15.7
Empire District Electric Co.	17.8	Nevada-California Electric Co.	29.0
Kansas Power & Light Co.	11.7	Pacific Power & Light Co.	20.6
Duke Power Co.	15.7	Washington Water Power Co.	20.1
Appalachian Power Co.	10.2	Jersey Central Power & Light	20.3
		No. Indiana Public Service	14.1
		Broad River Power Co.	12.9

* Energy used by utility included in losses.

Table II—Losses for Typical Metropolitan Companies

Edison Elec. Ill. Co. of Boston	16.0	Des Moines Electric Co.	13.8
Hartford Electric Light Co.	7.9	Sioux City Gas & Electric Co.	16.8
United Illuminating Co.	*13.0	Consolidated Gas, Electric & Power Co. of Baltimore	9.9
New Bedford Gas & Electric Co.	8.8	Tampa Electric Co.	12.2
N. Y. Edison System	*15.8	Potomac Edison Co.	17.7
Phila Electric Co.	10.8	Wheeling Electric Co.	16.2
Duquesne Lighting Co.	10.8	Louisville Gas & Electric	8.7
Rochester Gas & Electric	13.7	Birmingham Electric	10.0
Scranton Electric Co.	10.6	Memphis Power & Light	12.6
Atlantic City Electric Co.	18.1	Houston Light & Power	8.6
Central Hudson Gas & Electric	14.5	New Orleans Public Service	12.4
Erie Lighting Co.	5.3	San Antonio Public Service	15.8
Staten Island Edison Co.	8.9	Dallas Power & Light	10.0
Commonwealth Edison Co.	9.9	El Paso Electric	13.9
Detroit Edison Co.	12.1	Portland Gen. Electric Co.	17.7
Cleveland Elec. Illuminating Co	11.9	City of Seattle	20.1
Ohio Edison Co.	10.3	City of Tacoma	22.5
Indianapolis Power & Light Co.	14.9	San Diego Con. Gas Co.	15.5
Columbus Railway & Light	10.3	Toledo Edison Co.	14.3
Kansas City Power & Light	*9.7	Los Angeles Gas & Electric	12.1
Nebraska Power Co.	15.6		

* Energy used by utility included in losses.

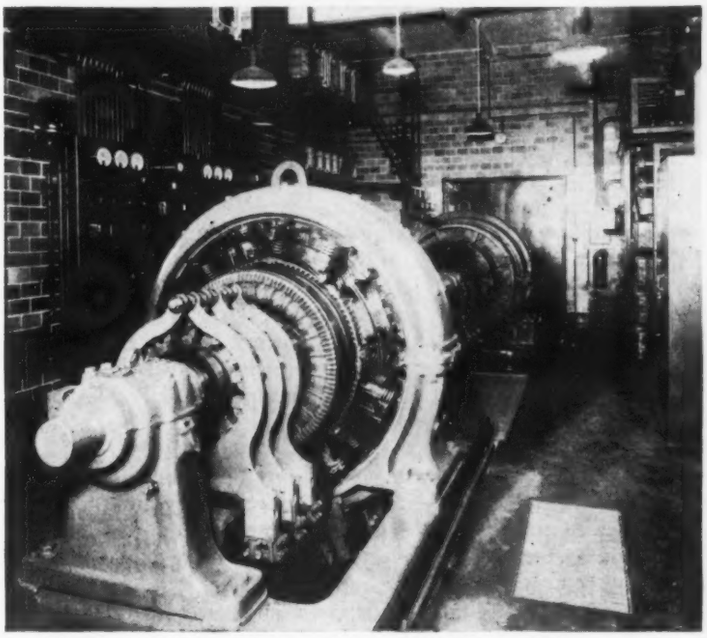
will be successively the secondary and primary distributing circuits and the distribution transformers. It will not be strange if the bulk of the recoverable loss is found in these items of system equipment.

When those items have been maneuvered in time to show decreased losses the savings still to be effected in feeders and transformation will prove to make slow inroads on the losses. Meanwhile, transmission offers a continuous opportunity through the medium of more judicious control of power and reactive flow. Here, however, the exigencies of stability and conformity with the superior economies of generation and interchange will be obstacles in the path of reduced losses. The emphasis will rest on the six kilowatt-hours profitably produced and sold rather than on the one which is unprofitably produced and lost.

An Efficient Direct-Current Substation

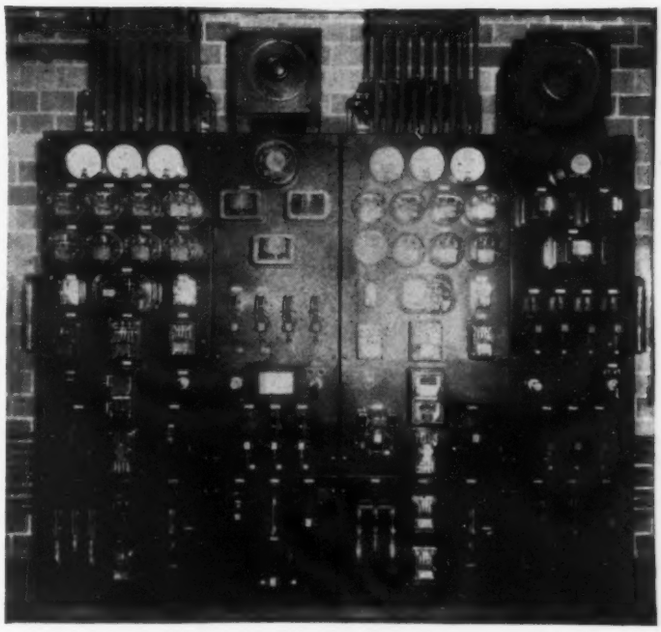
Through careful planning of space requirements, the elimination of unnecessary floor areas and the judicious selection of equipment, a number of economies were introduced at the 2,000-kw. direct-current Hays substation of the Pittsburgh Railways Company. This automatic conversion unit supplies direct current for railway service only, but the principles applied and results obtained relate to similar direct-current supply problems. In planning this station the staff of the Pittsburgh branch of the Byllesby Engineering & Management Corporation endeavored to avoid waste of floor or wall areas and to minimize building size without sacrifice of adequate space for operation and maintenance. Note the placement of the two 1,000-kw. rotary converters, the location of resistors and of house service transformers and control panels.

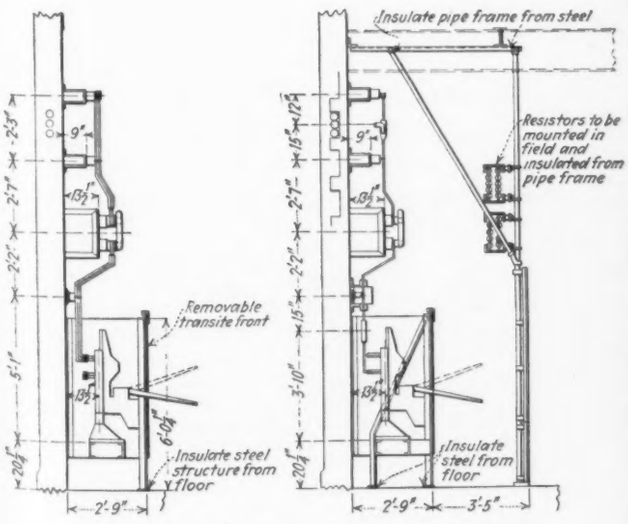
Equipment is so arranged that the current passes directly through the station with no overlapping or looping back. The unit principle of arranging equipment is employed, resulting in direct main connections and in short control connections. Here the adoption of pedestal-type circuit breakers mounted in small transite-fronted compartments enabled the elimination of more costly concrete barrier compartments as well as of separate direct-current boards for each feeder. The main heavy current-interrupting devices and busbars are thus removed from the relay board with its comparatively delicate instruments, which will result in better operation and lower maintenance costs. The automatic switchboard shown is notably compact also and fits well into the general plan of the substation.



Compact and well-planned automatic substation

Pedestal-mounted breakers cut costs





Control panel for operation of d.c. station

Springfield's Carrier-Current Street-Lighting Control Succeeds*

By R. E. CURTIS
Engineering Department, United Electric Light Company

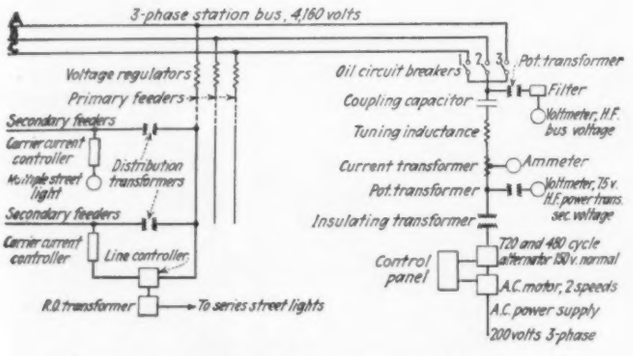
Advanced relay design used. 651 multiple lamps serve important residential section. Only 95 failures reported in 199,578 operations.

CARRIER-CURRENT control of multiple street lighting in the Forest Park district of Springfield, Mass., went into service last February and at the end of August the records of the United Electric Light Company show that the apparatus failed to function in only about 0.05 per cent of the operations required. This installation is the first the General Electric Company has made for street-lighting service. So far as the writer knows, it is the second of its type in the country, a resonant control installation for the Edison Electric Illuminating Company of Boston having been developed by the Westinghouse Electric & Manufacturing Company about three years ago for use in the Dorchester district (ELECTRICAL WORLD, November 10, 1928, W. W. Edson). The Springfield installation is of particular interest because of the relay design utilized in controlling the individual lamps, and its automatic features are also of much importance.

The special equipment required for series street lighting handicaps it for service under modern urban conditions. Special transformers which are valueless for other purposes are required even if supplying incandescent lamps, and the circuits supplying constant current often congest duct systems, which are expensive to enlarge. Low-voltage pilot wires for street-lighting control relays also occupy duct space and so do not represent the maximum possible saving by going to carrier-current control. Series lighting has economic justification in rural communities, outlying districts and some public parks, but multiple lighting with individual lamps turned on and off by relays actuated by carrier waves has many advantages for urban service, since it utilizes the existing distribution system without requiring additional conductors or segregated lines and equipment and does away with the high voltages so long associated with series lighting.

At the Forest Park substation a motor-generator has been installed to deliver control frequencies of the order of 700 and 460 cycles for superposition on the distribution system. The 700-cycle current is used in operating the relays at the street lamps, and the 460-cycle current is available for other purposes, such as controlled water heating of the off-peak type. In the Springfield installation the relay at each lamp and its associated switching equipment is designed to function on a single frequency for both on and off service, whereas in the Boston installation two frequencies are employed, one for starting and one for stopping the lamps.

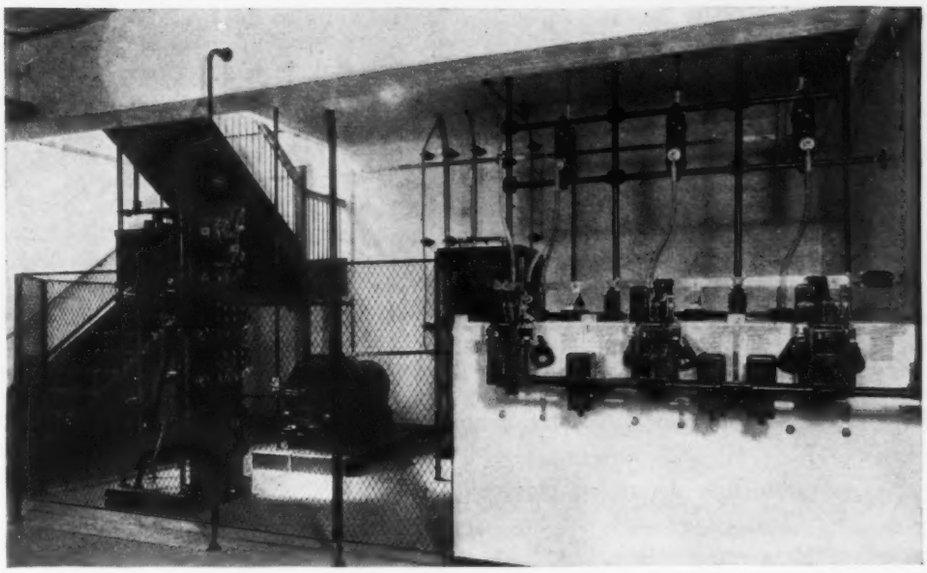
**Abridged from a paper presented at a meeting of the Springfield section, A.I.E.E.*



Connections of carrier-current equipment and distribution circuits

Phases excited in sequence

The generator at Forest Park is driven by an induction motor from the 60-cycle station service circuits. The high-frequency current passes through a transformer which is insulated for 2,300 volts to ground, and the secondary of this transformer is connected through a tuning inductance and a condenser to switches which connect successively to the substation bus phase wires. From the generator the high-frequency current is single phase, and since the distribution system is three phase the carrier current is placed on one phase of the bus at a time. Thus phases A, B and C are energized successively and not simultaneously. This is accomplished by three single-pole switches which are interlocked. The operation of these switches and of the generator is automatic, controlled by relays which in turn are operated by a supervisory control system from the State Street



Assembly of carrier-current supply unit and control apparatus at substation

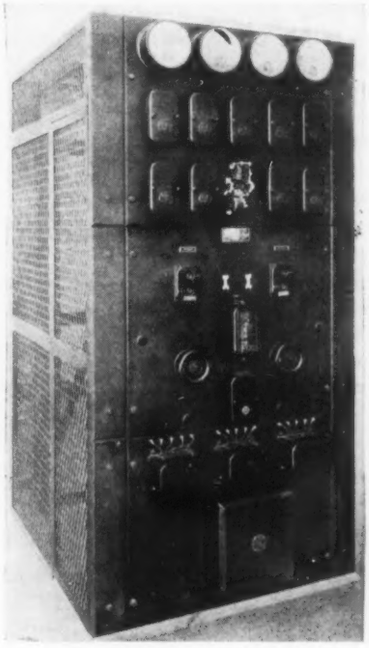
Motor-generator and master relay panel at left, oil circuit breaker controlling solenoids at right.

generating station. The equipment may also be manually controlled at Forest Park.

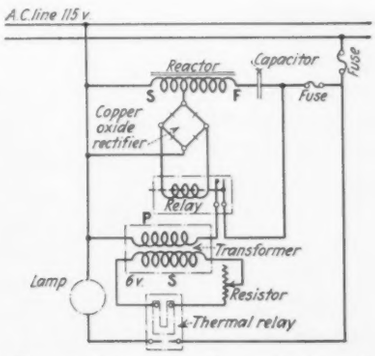
A tuning inductance and condenser at the generator are necessary to control the amount of high-frequency current on the bus. Adding transformer banks or cables to the distribution system, which operates at 4,160/2,400 volts grounded Y, will affect the current flow from the generator. By retuning the inductance and condenser to resonance the carrier current value may be restored to its proper value. Either the condenser or the inductance may be adjustable. It is easier to make the inductance adjustable, and that is the case of Forest Park.

The 4,160/2,400-volt bus supplies all of the distribution primaries from this substation, and these primary cables run underground to the distribution transformers. The carrier-current energy from the small 700-cycle generator, therefore, is spread out over the entire distribution system, flowing through all distribution transformers. A portion of this energy also flows backward through the main transformers and into our 13,200-volt transmission system; it is, however, of insufficient magnitude to operate any carrier-current control relays elsewhere. The tuned inductance and condenser at the substation also prevent the flow of 60-cycle energy back into the 700-cycle transformer and generator. If the generator were insulated for 2,300 volts the transformer might be omitted.

The carrier-current relay of each street light is operated by the superimposed 700-cycle current. These relays have a condenser and reactance tuned to 700 cycles to filter out the 60-cycle energy and pass only the carrier current into the active circuit. The controller consists of simple circuits comprising standard equipment, all inclosed in the same case. The relay is suitable for mounting in the base of an ornamental lamp pole, or for hanging outdoors at the top of a wood pole. These relay units are dust- and moisture-proof and are arranged with a sub-cover to permit fuse removal and manual operation of the load contacts without opening the entire relay cover. Definite precautions were taken in the de-



Master control panel for automatic carrier-current operation



Connections of relay-switch unit at multiple street lamp

Individual relay-control switch in street lamp base

sign to prevent faulty operation from mechanical vibrations set up by street traffic.

Terminals at the bottom provide for connecting the controller to any 115-volt a.c. secondary and for connecting to a street light. A plug fuse protects the 115-volt secondary from a failure of any part of the entire equipment.

The primary circuit of the relay consists of a reactance and a condenser connected through a copper oxide rectifier and placed across the 115-volt incoming supply. The condenser and reactor are tuned to 700 cycles, and whenever a station operator places the 700-cycle frequency on the lines this tuned circuit picks up a sufficient amount of energy to cause an appreciable direct current to flow through the copper oxide rectifier. This direct current flows through a telephone type relay, causing its contacts to close.

Application time determines closure or opening

Closing the contacts on the telephone relay passes current through a small 60-cycle, 115-volt transformer at the bottom of the relay. The secondary winding of this transformer is connected to a bimetallic thermal strip. A current flowing through this thermal strip causes it to heat, and in heating it bends and trips on a mercury contact switch. This switch is the main contact of the relay and is capable of handling an incandescent lamp load of 20 amp. at 115 volts a.c.

As soon as the 700-cycle impulse is shut off by the station operator the copper oxide rectifier ceases to function, the telephone relay opens and the small transformer is dead, allowing the thermal strip to cool off.

If the 700-cycle current is kept on longer the bimetallic strip gets hotter and bends over further. If this strip bends far enough it will release a catch, so that on returning to its cold position it resets the relay, opens the mercury switch and turns the lamp off. The street lights are, therefore, turned on or off according to the length of time the impulse of 700 cycles is maintained by the station operator. The time for turning on is eight seconds and the time for turning off is 30 seconds.

A small fuse at the top of this relay is in the control circuit. A bent wire with the coil spring projecting below the lower plate affords hand control. Raising this wire trips the relay off and turning it closes the relay. This is for the use of inspectors.

Precautions were taken in the design of the relay to reduce the effect of temperature to a negligible point and to make the controllers sufficiently selective to assure definite freedom from interference from the lower control frequency of 460 cycles.

System automatic after initial impulse is applied

In considering the operation of the street-lighting system from the substation through the relays the operation is entirely automatic. Thus, to turn the street lights on, the proper push button is pressed, either manually or by supervisory control. Once pressed, the push button is locked in and the entire operation is completed automatically. First, the motor-generator is brought up to speed, the proper voltage tap is selected on the output transformer and the proper inductance value is inserted in the circuit to resonate the output to the particular carrier frequency involved, either 700 or 460 cycles. Oil circuit breaker No. 1 then closes to energize phase *A* of the station bus to neutral. At the end of eight seconds this breaker drops out and oil circuit breaker No. 2 closes to energize phase *B* to neutral. This breaker also remains closed for eight seconds, then drops out, and breaker No. 3 comes in to energize phase *C* to neutral for eight seconds. At the completion of this cycle the motor-generator shuts down and the apparatus is ready again to perform any of its four-position cycles.

No difficulty has been encountered either with the equipment or in obtaining sufficient carrier energy to operate the controllers. With a normally loaded 20 to 1 ratio transformer the application of 100 volts of carrier on the primary will give about 4 volts at the secondary terminals (as against a theoretical maximum of 5 volts) and at the end of a normally loaded feeder approximately 3 volts. Since the controllers operate successfully on a minimum of one volt, this results in a large factor of safety. The voltage required on the line is, of course, determined by the sensitivity of the controllers, but the amount of power required is dependent mainly upon the station load. For a station load of 3,500 kw. a high-frequency output of about 5 kw. is used, which allows a generous margin to insure positive operation of the controllers.

There are now in operation 456 carrier-current controllers or relays. These relays control a total of 651 incandescent lamps of the multiple type, totaling 142 kw. As an example of the reliability of operation, failures for the first seven months, February to August, 1931, have totaled 95 out of 199,578 operations, or about five-hundredths of 1 per cent.

Those in the United Electric Light Company who are responsible for the maintenance and operation of street lights have been very well pleased with the operation of this system.

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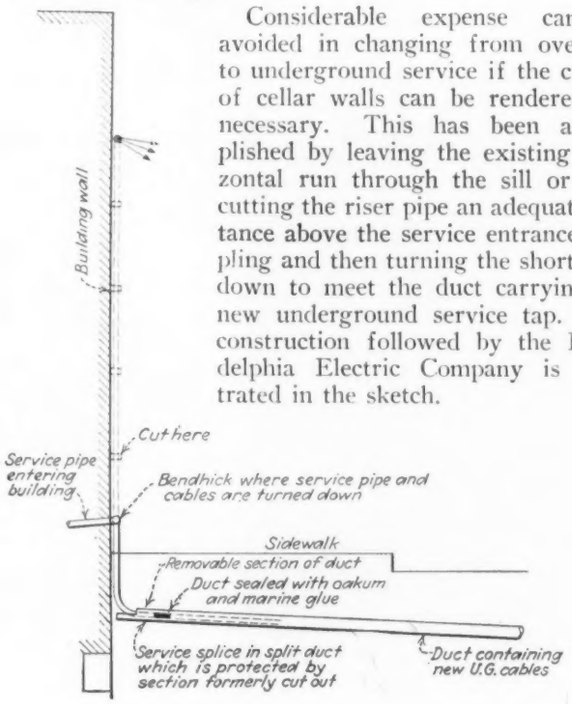
Overhead Entrance Converted to Underground


Building wall
Cut here
Service pipe entering building
Bend thick where service pipe and cables are turned down
Sidewalk
Removable section of duct
Duct sealed with oakum and marine glue
Service splice in split duct which is protected by section formerly cut out
Duct containing new U.G. cables

Considerable expense can be avoided in changing from overhead to underground service if the cutting of cellar walls can be rendered unnecessary. This has been accomplished by leaving the existing horizontal run through the sill or wall, cutting the riser pipe an adequate distance above the service entrance coupling and then turning the short riser down to meet the duct carrying the new underground service tap. The construction followed by the Philadelphia Electric Company is illustrated in the sketch.

Russia Offers Large Opportunity for American Industry

Says Colonel Cooper

Holds it stupid to reject market of $2,500,000,000 in seven years.

Menace of communism vastly over-rated.

"THROUGH our loans to Europe we are financing European competitors to get Russian business away from us, and while we are doing this we assume as big a financial risk as though we undertook the business direct," declared Col. Hugh L. Cooper in an address before a recent meeting of the New York section of the American Institute of Electric Engineers. "And I can assure you that the competition in Europe for this business is most intense and they are chuckling over our stupidity in not accepting the invitation of the Russians to a very profitable business relationship."

Regarding criticisms of American engineering participation in Russian development, Colonel Cooper said that if an American engineer accepts money from a foreign government, while believing that it is attempting subversive acts against his own, then he is a traitor. But no evidence has been found of such attempts. Prominent American companies are represented in the Russian-American Chamber of Commerce. These companies would not do business with a government if they thought it subversive to our own, Colonel Cooper stated.

The speaker made it plain that he held no brief for the Soviet doctrine and that he disagreed with certain features of it and had no hesitation in saying so. But he maintained that no good could come from ignoring facts. His address, somewhat condensed, follows:

Electrification is practically a new industry in Russia. In 1913 the total power generating capacity in the whole country was only 1,078,000 kw. Realizing the importance of developing this industry to serve as a basis for the industrialization of a hitherto agrarian country, the first plan for the electrification of the Soviet Union was drafted in 1920 on the initiative of Lenin.

The actual program of development was not effectively begun, however, until 1922, due to the disorganization of the country caused by the World War, revolution and the subsequent civil war. In 1920 industrial production had fallen to 20 per cent of the pre-war level, and agricultural production to 45 per cent. Coal mining had practically ceased. Steel mills were shut down and the transportation system so badly dislocated that intercourse between the various sections of the country was extremely difficult.

The Ten-Year Plan drafted in 1920 for the electrification of Russia specified the construction of some thirty new central power plants with a total capacity of 1,500,000 kw. At the end of December, 1930, the capacity of all power stations in Russia amounted to 2,800,000 kw., or substantially in excess of the plan.

In 1913 the total annual production of kilowatt-hours amounted to 1,945,000,000; for the year 1930 the production amounted to approximately 8,800,000,000 kw.-hr.

Capital expenditures in the electrical industry during the years 1929 and 1930 aggregated about $400,000,000.

It is possible that the progress in electrification would have been greater if new construction had not been dependent in a considerable degree upon the importation of turbines and generators. During 1929 and 1930 the imports of electrical machinery and supplies amounted to $40,000,000.

In order to increase the rate of progress of electrification of the country, attention has been turned to electrical engineering and production of electrical machinery in Russia. The production in this branch of industry in 1929 was valued at $135,000,000, while in 1930 it rose to $250,000,000, or practically doubled in one year. The Russians have been aided by technical assistance from leading American firms who have assisted in the production of electrical machinery in Russia.

I am reliably informed that the manufacture of electric lamps and transformers is now sufficient to satisfy the domestic demand. The output for the year 1930 was 32,000,000 lamps and 5,630 transformers of various sizes.

The chief electrical manufacturing works are located in Moscow. Its output includes transformers, low- and high-tension apparatus, special equipment for automobiles and tractors, lamps, lighting equipment, etc. More than 5,000 workers are now employed in this plant.

In the Leningrad electrical machinery works turbogenerators are being produced up to 24,000 kw. capacity for installation in the larger steam power plants.

The foregoing statistics are those used by the government in planning its national economic program, and as to their accuracy, I can say that in the more than five years that we have been working in Russia we have yet to

find one single instance of misrepresentation or inaccuracy in any of the statistics furnished to us by the government.

U. S. can keep ahead of Russia

While all of the foregoing progress records a notable achievement and one which challenges admiration, it should be pointed out here that it will be a long time before the visions of an electrified Russia will materialize. If we compare the electrification program in Russia with that of the United States we find that the existing power capacity and production in the United States is today more than ten times that of Russia. And most of the new power plants in Russia have been built to supply motive power for the heavy industries, which consume large blocks of power, so we can readily appreciate that the power is nowhere near as widely distributed as in this country. It will be a more complex problem to electrify the homes of the Russian people than it was to electrify the factories and we can naturally expect them to take longer to achieve this kind of distribution than it has to accomplish the industrial power program.

The budget for electrification in Russia for the year 1931 was $395,000,000. This is a sizable figure and the government is to be congratulated on its wise provision. But when we compare this amount with the budget of the public utility industry in the United States for the year 1931 we find that it was to spend nearly $900,000,000.

The foregoing comparison between the United States and Russia is not cited in disparagement of the great progress being made in Russia, for after all, the United States leads the world in electrification, but I am presenting it here to appease the minds of those who have become frightened by the alarmists who go about the country with sensational predictions of the Soviet menace to our economic and political systems. Russia has a long way to go to catch up to us in electrification and industry and we are not standing still ourselves. I am one of those who prefer to believe we can keep several jumps ahead of our Russian friends in this kind of a competition.

Electrical energy is transcendental in its importance to industrial production of the mass character. Costs of electrical energy in Russia very naturally are still considerably higher than in the United States and will continue to be higher until the Russians, through years of hard work, have acquired the practical experience necessary to achieve the degree of efficiency that obtains here. This is bound to be reflected in the costs of whatever manufactured articles they produce using electrical motive power.

Dnieprostroy industrial combine

The creation of large industrial combines, or trusts, in connection with power developments has become an outstanding feature of the general plan for the industrialization of the Soviet Union, and is made possible by the centralization of the economic and administrative systems of that country.

An example of such a combine, on an extraordinary scale, is the Dnieper Industrial Combine, planned in connection with the Dnieper River hydro-electric development, "Dnieprostroy." When this power plant is completed, in 1933, it will become the largest in the world, with a generating capacity of 560,000 kw. and a yearly power production of about 3,000,000,000 kw.-hr. The power from this enormous unit will be mostly consumed by the huge industrial plants of the combine, the construction of which is being carried on concurrently with the building of the power plant. The industrial combine will include large electrometallurgical, aluminum, chemical and fertilizer plants, covering an area of about 14 square miles and located approximately 3 miles distant from the power plant. The total sum now allotted to this industrial combine, including permanent houses for the resident workers in the new industries, is $350,000,000.

In addition to supplying the requirements of the industrial combine, the plant will supplement the power needs of adjacent industrial centers, such as the iron ore mines at Krivoy Rog, 85 miles west of Dnieprostroy; the manganese works at Nicopol, 35 miles to the southwest; the Petrovsky Metal Works in Dniepropetrovsk, 40 miles north, and the coal fields of the Donetz Basin, 115 miles east.

From the initial power installation the following amounts have been tentatively allotted to these industries: Aluminum plant, 100,000 kw.; steel and coke works, 40,000 kw.; ferro alloys, including ferromanganese, ferrochrome and ferrosilicon, 100,000 kw.

In addition, transmission lines are now being erected to carry Dnieprostroy power to the industrial city of Dniepropetrovsk, 40 miles to the northeast, where it will be applied to metallurgical production and general manufacturing.

The Dnieper power development, on the "Dnieprostroy," is located in the vicinity of the town of Kichkas, Republic of Ukraine, about 200 miles up the river from the Black Sea.

The project includes the construction of a concrete gravity type dam at the foot of a series of rapids. The dam, which is slightly curved in plan, extends across the river for a total length of 2,500 ft. and will raise the water a maximum of 120 ft. A three-flight navigation lock, being constructed on the left bank, will make the river navigable from its mouth to several hundred miles upstream of the dam. The power house, located on the right bank, will contain nine generating units, each of 62,000 kw. capacity. The total cost of the power development is estimated at $110,000,000.

The generating units of the power station are of American design and manufacture and embody all of the latest and up-to-date features available for machinery of this type.

The construction of "Dnieprostroy" was started in the latter part of 1927 and has since been progressing satisfactory and on schedule time in spite of the innumerable and difficult engineering problems that must be contended with in connection with placing permanent structures on dependable foundations in the bed of a broad, deep and swift flowing river.

A proof of the correctness of the construction methods employed and a test of the sufficiency of the approved design of the component structural parts presented itself when, in May of this year, the half-completed permanent structures and their cofferdams were subjected to and successfully withstood a record flood discharge of the river of 835,000 cu.ft. per second, the greatest amount of water ever known to have been encountered in engineering history.

The early accomplishment of the project can now be confidently predicted. The construction hazards have been successfully surmounted and the work remaining to be done is of a character that nothing can interfere with the ultimate success of the project.

There is now under active preparation a second Ten-Year Plan of electrification. In my opinion this plan will create increasing opportunity for sales of electrical equipment and apparatus to Russia. Similarly, it will create more opportunities for engineering service in Russia. To what extent either of these needs will be filled from America I am not qualified to answer in the light of existing conditions. I believe, however, that as a result of the competition now under way in Russia between American engineers and machinery versus engineers and machinery of European origin the success of American participation will persuade the government to enlarge upon its American commitments substantially.

There is this to be said, however. American practice and American equipment standards differ in many important respects from those of Europe. The extent to which our manufacturers are willing to consider the Russian market will determine in an important measure whether Russia is to adopt American electrical engineering practice, for it follows that if they purchase European machinery they will engage European engineers to install it.

Whose market—American or European?

The next few years will determine whether Russia is to develop according to American or European methods. If we in the United States are to obtain our share of this great potential and rapidly expanding market for machinery and engineering, we will have to give more serious consideration to the matter than we have exhibited to date. By neglecting this opportunity, we may force the Russians to turn to Europe despite their present very keen preferenee for American assistance.

Since we lead the world in electrical development, it seems to me that we are entitled to a substantial part of this valuable business.

As a direct result of bad judgment on the part of the world's financial leaders, Germany has been financed way beyond her capacity to pay, and the matter of short-term loans to Germany by America and England and France of about $1,500,000,000 due next February is only a part of the millstone that unnecessary ignorance has hung upon the back of world business. How can we be expected to be full of confidence in our economic leadership with such a sad situation constantly in sight!

Any kind of intelligent analysis will show conclusively that Russia is the greatest potential, readily available buying market in the world today, because its low standard of living should be raised way beyond what it is now, because it has the natural resources to justify the raising of the standard of living, and because in the last seven years it has bought around $2,500,000,000 worth of goods from the outside world without a single default in a promise to pay and without the levy of a dollar of graft, so far as my investigations have been able to discover. It seems to me that the Soviet business record compared with the defaults in the balance of the world during the same period should cause our American bankers and business men to wake up and look into this Russian potentiality with a constructive rather than the present hysterical approach.

Every so often one hears criticism of American engineering participation in the Russian program of economic development, based on the fallacious theory that Russia is or may become a menace to our economic and political institutions. Such criticism, in my judgment, emanates from uninformed, misinformed and prejudiced sources. A fair, intelligent analysis of the facts will show that by assisting the Russian people to achieve a better standard of living we will remove much of the mutual misunderstanding that exists between the Russian people and the outside world. I am convinced that as these advances in living standards are achieved, communism, *per se,* will fade out and a new "ism" will take its place that will be much closer to what we call capitalism than it will be to communism. As a matter of fact, they have state capitalism today in Russia, although I am sure they would be the last to admit it.

It is becoming more apparent every day that the United States, with our unquestionable historical and economic qualifications, must assume the leadership if we are to solve the problem of how to restore world economic stability. In my firm opinion, we cannot go about it in any better way than to find a means to open up the great Russian buying market, which in itself can provide the stimulus that world business so badly needs to reverse the present downward economic trend.

It is high time American common sense and initiative be applied to this great opportunity for world good. The Russian problem is no longer a European problem. It is and will continue to become even more so an American problem.

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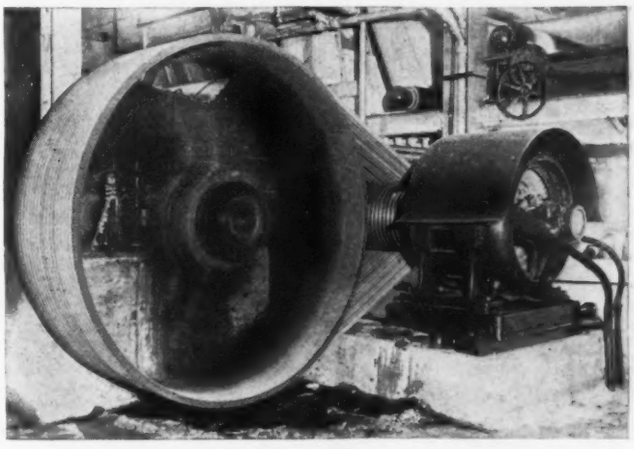
Compact Beater Drive Achieved



Space limited by column location and the need of attaining a large speed reduction from motor to a beater shaft led to the use of Allis-Chalmers "Texrope" drive in the new mill of the Main Seaboard Paper Company at Bucksport. A three-bearing, 150-hp., 2,200-volt, three-phase induction motor running at 350 revolutions per minute drives the beater shaft at 80 revolutions. The shaft centers are only 78.5 in. apart and the pulley diameters 22 and 96 in., with 30.25-in. faces. The drive consists of seventeen belts, each 1x1.5 in. in dimensions and 360 in. long.

Economical Rural Line Construction

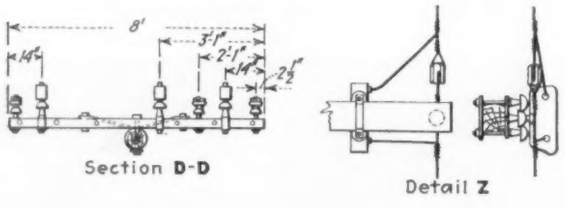
By C. M. JENNINGS

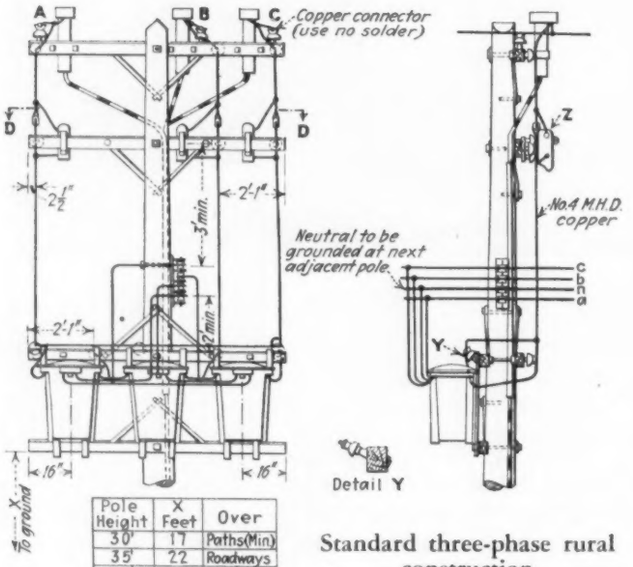
Electrical Engineer
Green Mountain Power Corporation, Burlington, Vt.

The Green Mountain Power Corporation of Vermont, a subsidiary of the Peoples Light & Power Corporation of New York, has in the past eighteen months developed and put into effect a company-financed rural electrification plan based upon a monthly minimum charge, depending upon the number of customers per mile.

This plan has been well received by the farmers of north central Vermont. More than 70 miles of extension have been built to serve more than 200 farm customers. The company-finance feature of the plan has worked out well in that the farmer has had more funds available for this wiring and the purchase of appliances. We find that the farmers are not only using their monthly minimum, but in most cases are exceeding this amount by a good margin.

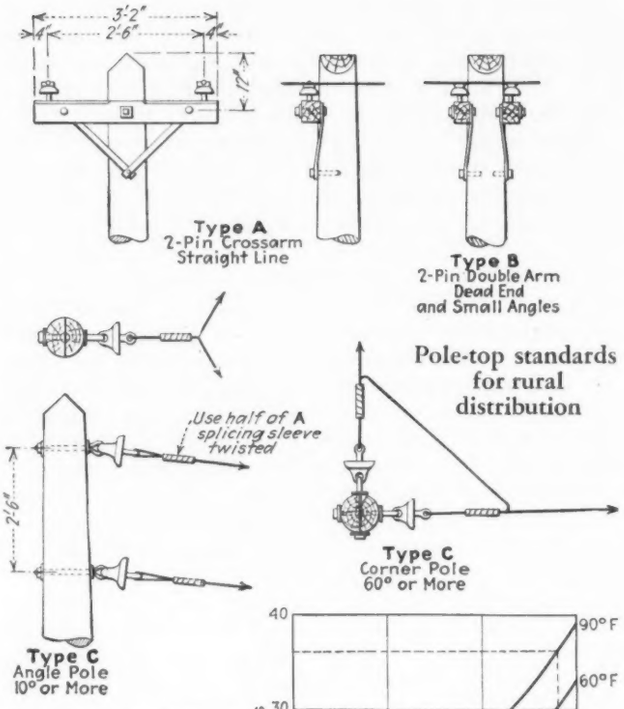
Two-pin 6,600-volt construction on 6-in. top, 25- and 30-ft. poles has been used on all extensions. Practically all of the extensions built have followed the highway, making necessary an average span of 170 ft. This span has been very satisfactory with a No. 6 bare copper conductor. Vertical construction has been used on all corners over 10 deg.



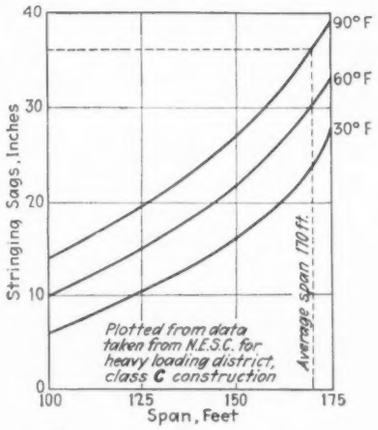


Pole Height	X Feet	Over
30'	17	Paths(Min)
35'	22	Roadways
40'	27	Special

Standard three-phase rural construction



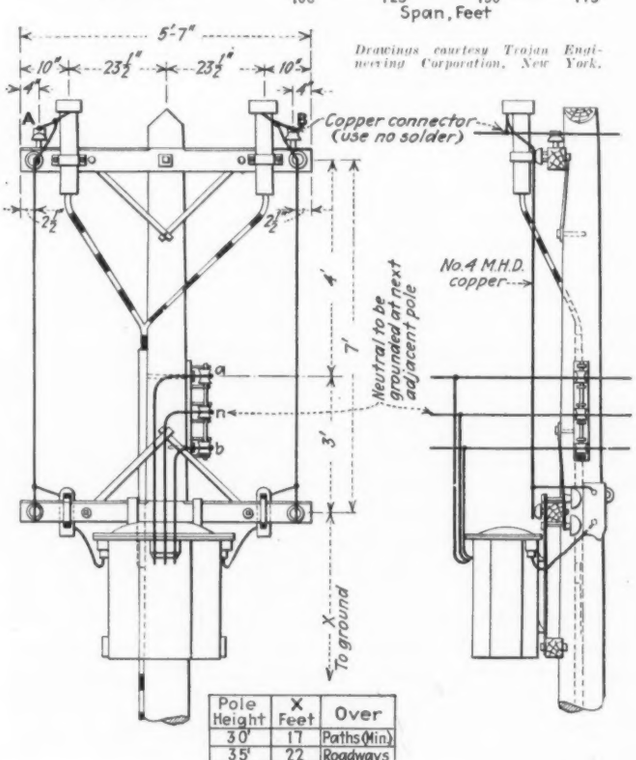
Pole-top standards for rural distribution


Stringing Sags, Inches
Span, Feet
90° F
60° F
30° F
Average span 170 ft.
Plotted from data taken from N.E.S.C. for heavy loading district, class C construction

Sag table for No. 6 medium hard-drawn copper

Standard single-phase rural extension with racked secondary mains and grounded neutrals

Drawings courtesy Trojan Engineering Corporation, New York.



Pole Height	X Feet	Over
30'	17	Paths(Min)
35'	22	Roadways
40'	27	Special

Cost of Typical Single-Phase, 6,600-Volt Rural Extension

The costs for a typical mile extension, built over a hill country, where considerable trimming was necessary, amounted to $1,961.26, as follows:

Poles, Towers and Fixtures		
8	30-ft. native cedar poles	$33.66
72	25-ft. native cedar poles	202.20
63	two-pin arms	24.32
14	5-ft. arms	11.05
154	locust pins	4.93
154	carriage bolts	2.93
154	round washers	0.80
154	galvanized braces	12.01
84	10-in. through bolts	5.76
19	11-in. through bolts	2.79
12	12-in. through bolts	0.97
3	18-in. through bolts	0.26
5	14-in. through bolts	0.44
4	16-in. through bolts	0.36
6	18-in. space bolts	0.73
1	14-in. space bolt	0.18
2	16-in. space bolts	0.25
81	galvanized lag screws	1.38
243	square washers	3.65
20	LM bolt pins	4.10
14	8-in. eye-bolts	1.75
14	10-in. eye-bolts	2.00
2	¾-in. eye-nuts	0.55
5	transformer rests	1.66
11	wedge lock anchors	30.25
72	three-bolt clamps	15.98
625	feet 5/16-in. galvanized guy wire	7.26
38	clevises	11.70
26	thimbles	1.20
10	three-wire racks	6.78
5	two-wire racks	3.00
	Miscellaneous	$5.30
	Hauling poles	8.00
	Stores expense	40.20
	Labor	372.93
	Liability insurance	15.32
	Transportation	76.06
	Total	$912.71
Overhead Conductors		
23,813	ft. No. 6 bare copper	$262.70
422	lb. No. 6 triple-braid, weatherproof wire	83.98
3	A-105 insulators	0.28
40	506 strain insulators	11.72
150	"Pyrex" insulators	14.40
45	rack insulators	3.60
12	No. 6 sleeves	0.79
18	504 strain insulators	2.79
	Store expense	39.28
	Labor	61.53
	Liability insurance	2.52
	Transportation	11.38
	Total	$494.97
Services		
205	lb. No. 6 triple-braid, weatherproof wire	$30.34
21	insulators	1.95
18	Beardsley house hooks	4.12
1	lb. friction tape	0.27
	Stores expense	4.50
	Labor	21.40
	Liability insurance	$0.88
	Transportation	2.56
	Total	$66.02
Transformer Devices		
12	primary cutouts	$86.05
4	lightning arresters	51.80
5	8-ft. ground rods	7.63
36	wire connectors	9.29
30	lb. No. 6 triple-braid weatherproof wire	5.97
	Paste, solder and tape	0.69
5	ground clamps	1.99
	Store expense	10.08
	Total	$173.50
Transformer Installation		
	Labor	$17.83
	Liability insurance	0.73
	Transportation	6.19
	Total	$24.75
Meter Installation		
	Labor	$6.83
	Liability insurance	0.28
	Transportation	8.06
	Total	$16.17
	Engineering, superintendence and rural expense	$273.14
	Total cost	$1,961.26

This type of construction has been very economical, the cost per mile, exclusive of transformers and meters, but including all transformer devices and installation, averaging between $950 and $1,000 per mile. We have been able to eliminate the cost of rights-of-way by using the highway, and by asking the farmer to donate a right-of-way where it is necessary to cross his private property. One man with local labor digs all holes for poles and anchors and delivers the poles. A small crew with local help then sets the poles, followed by linemen who run the wire and services and set the transformers.

Rural extensions so built have not only been economical to construct, but they have been very satisfactory from a mechanical and electrical standpoint.

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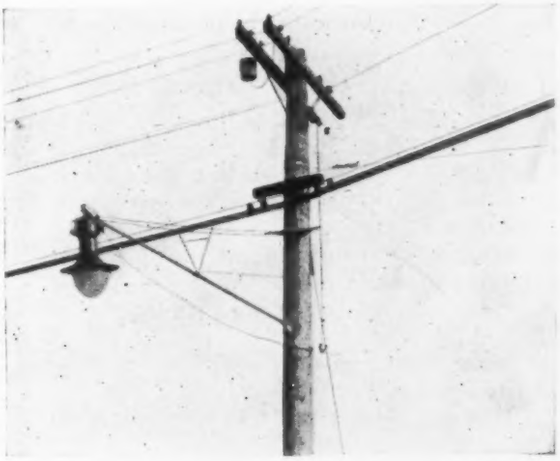
Aerial Cable Serves Economically and Well

In reaching a decision as to the type of construction to be utilized on the 14-mile Chatham-Livingston-Millburn-Springfield-Chatham loop of the Jersey Central Power & Light Company the engineers selected aërial cable. This 13.2-kv. line passes through territory which is bountifully supplied with fine shade trees throughout most of the loop. Open-wire overhead construction was virtually unthinkable because of the tree trimming which would have been required, both in the first instance and for maintenance, and because of the prohibitively costly alternative of using poles of extra length to clear the trees.

According to engineers, the aërial cable design, incorporated solely on an economic basis, has proved highly satisfactory. The cable used is of the steel-armored type, suspended from "Copperweld" messenger and loops.

Special efforts were made to obtain an installation which would minimize telephone interference, and, according to the engineers, the results have been most gratifying. Factory tests of this steel-armored cable showed 83 per cent shielding, but when suspended as previously mentioned 92 per cent shielding was obtained as installed. The use of steel-armored cable instead of the usual exposed lead-sheath type both offered protection from rifle shots at the hands of mischief makers, a common occurrence in this territory, and reduced void formation, with a consequently improved life characteristic for the cable.



Aerial cable which reduced telephone interference and line costs

Arc Energy Liberation Fixes Breaker Pressures

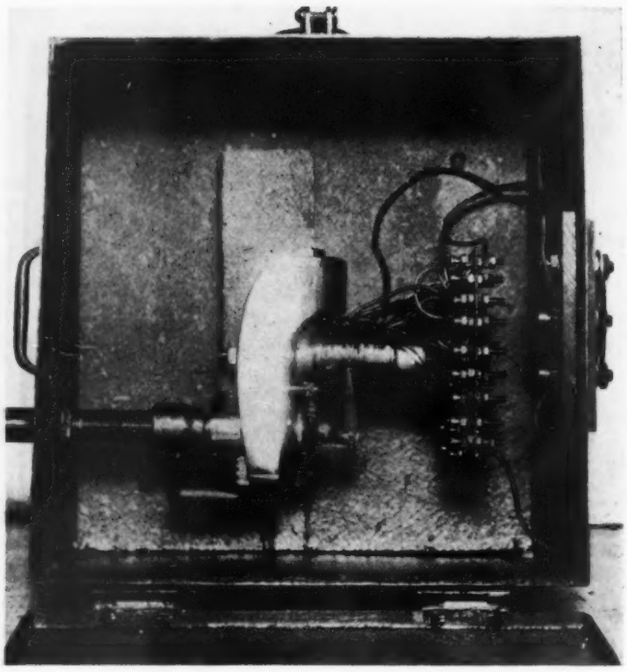


Fig. 1—Gas engine indicator modified for tank tests

By W. M. LEEDS

Circuit Breaker Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A CONSIDERATION of the problems of pressures in oil circuit breakers immediately suggests a number of questions such as the following:

1. Upon what factors does the maximum pressure developed in an oil circuit breaker depend?
2. What is the nature of the pressure variation during the rupture of an arc ?
3. What effect does the pressure have on arc extinction?
4. What makes an oil circuit breaker tend to jump from its foundations?
5. How may high-speed arc rupture be obtained without producing excessive stresses?

An oil circuit breaker interrupts an alternating current by drawing an arc under oil between rapidly separating contacts, until at a certain current zero the dielectric strength of the medium between the contacts recovers more rapidly than the voltage tending to restrike the arc can build up. The energy liberated by the arc is the integrated product of the instantaneous arc voltage and current over the arcing period. The high temperature of the arc causes the vaporization and decomposition of a quantity of oil, generating an amount of gas almost directly proportional to the arc energy. If the contact opening speed is comparatively slow the arc energy liberated during the first few current cycles is so small that the formation of the gas bubbles becomes a rather gradual process, proceeding slowly enough so that the oil can be displaced with relatively low pressure. On the other hand, a high contact velocity or a very strong magnetic blowout causes rapid arc lengthening, which in turn increases the rate of energy liberation and the corresponding rate of generation of gas. Pressures of considerable magnitude may be built up before the inertia of the oil can be overcome and the gas bubble allowed to expand. This pressure impulse is transmitted through the oil to the tank as a spherical wave of rapidly diminishing amplitude. This means that the pressure impacts on the tank itself have only a fraction of the value of the pressure pulsations in the gas bubble.

The magnitude of the initial pressure peak is affected not only by the speed of arc lengthening but also by the asymmetry of the current wave and by the head of oil above the contacts. An unsymmetrical short circuit increases the rate of gas generation, while a large oil head provides greater inertia resistance to the expansion of the gas bubble.

Rate of arc energy liberation important

The effect of the rate of energy liberation has been determined by an analysis of the results of a number of short-circuit tests of 4,000 to 15,000 amp. at 13,200 volts interrupted by a single pole of a plain-break oil circuit breaker having a relatively high contact-opening speed. Wide divergence was found in the magnitude of the pressure impulse for a given value of interrupted current. The values ranged from 3.3 to 12.5 lb. per square inch per thousand amperes with currents up to 15,000 amp. Thus, the actual stress in a circuit breaker may vary over a wide range during repeated tests with practically identical conditions of the external circuits.

Also, there is a wide variation in the ratio of peak pressure to arc energy liberated in the interrupting process. Here values were found from 8 lb. per square inch per 100 kilowatt-seconds to 21 lb. for arc energy up

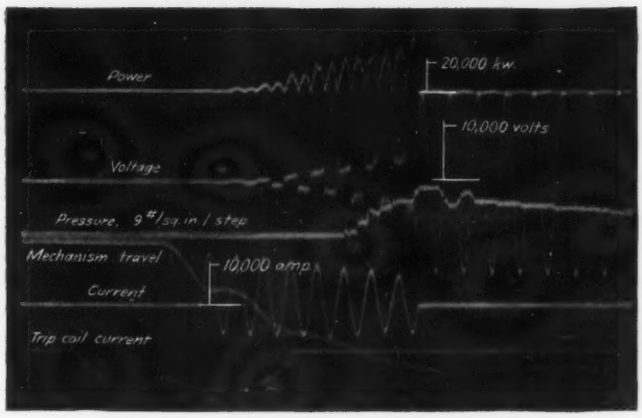


Fig. 2—Pressure rises slowly in slow breaker
Small slow-speed breaker shows relatively slow rise of pressure to the instant of arc extinction.

to 1,200 kilowatt-seconds. The relationship becomes much more nearly linear when pressure peak amplitude is associated with maximum amount of arc energy liberated during any single half cycle of arcing. The results of these tests only varied 20 per cent either side of a value of 37 lb. per square inch per 100 kilowatt-seconds per half cycle. The conclusion is that the actual stress on an oil circuit breaker is directly proportional to the rate of liberation of the arc energy.

Records of the pressure variation at the tank wall during the process of arc ruptures were obtained by the use of a device which is an adaptation of a high-speed gas engine indicator arranged so that the motion of the piston, instead of tracing a record on an indicator card, causes an arm to move over a series of contacts. Equal values of resistance are connected between the contacts in a potentiometer circuit so that a potential drop will be applied to an oscillograph element proportional in value to the number of contacts passed over by the moving arm. A stepped pressure wave is thus recorded on the oscillogram, the amplitude of which is measured by counting the number of steps and multiplying by a constant expressed in pounds per square inch per step. The recorder is connected by means of a flexible tube to the drain valve at the bottom of the circuit breaker tank.

Sufficient gas is sometimes generated in an oil circuit breaker to lift a "piston" of oil which may force out practically all of the air and perhaps a little oil before

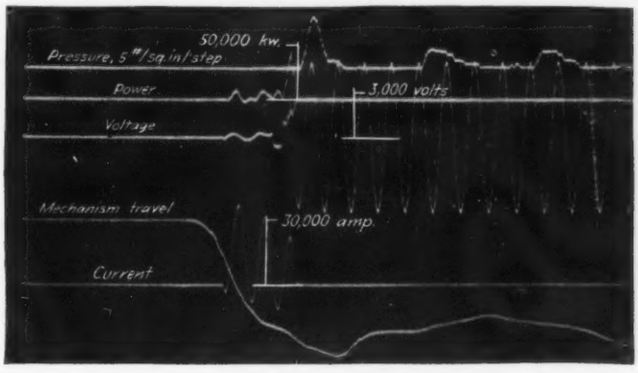


Fig. 3—Pressure surges accompany current interruption
Steep wave pulses from 18,000 ampere broken at 4 kv. in moderate capacity breaker.

arc extinction takes place. When the circuit is cleared the oil and gas mix in a turbulent manner and normal pressure is gradually restored. This is the type of phenomenon which has been observed and photographed in glass wall circuit breaker models. An oscillogram of a circuit interruption in a small slow-speed breaker illustrating the pressure variations under such conditions shows that the pressure increases during the arcing period, reaching a maximum at or near the moment of arc extinction, and then falls off gradually as the gas is vented from the breaker. If a pressure recorder could be located close to the gas bubble it would show pressure pulsations of double line frequency superimposed on the rising pressure wave, caused by the variations in energy liberation with the alternations of the arc current.

However, in the medium and large capacity oil circuit breakers, especially where contact speeds of 8 to 15 ft. per second are employed, the tank walls were found to be subject to a succession of pressure surges of steep wave front, which were sustained for a considerable time

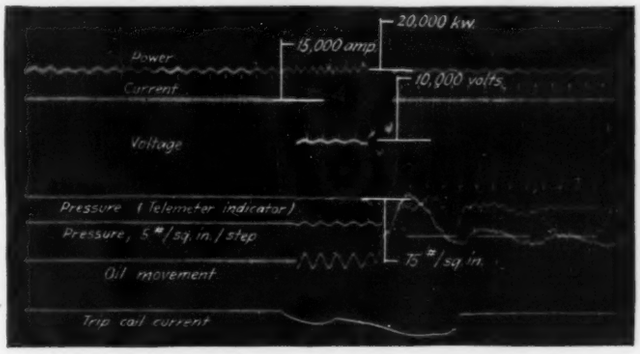


Fig. 4—Oil oscillates in step with pressure pulses

following the extinction of the arc. The maximum pressure peak apparently was not reached until shortly after the circuit was cleared.

It is believed that these pressure waves are directly connected with the surging of the oil in the circuit breakers. This theory has been verified experimentally by taking oscillographic records of the oil motion.* A "micarta" disk was suspended beneath the oil surface by means of a fiber rod passing up through the breaker cover. At the upper end of the rod a contact was arranged to slide along a resistance wire, and connected electrically so that a potential proportional to the displacement of the disk was recorded by the oscillograph. From an oscillogram (Fig. 4) it is clear that there was an oscillation of the oil which corresponded in frequency to the pressure wave following the extinction of the arc. The low gas pressure between successive peaks is due to the rapid cooling of the gas, and also to the inertia of the oil piston which carries it upward for some distance after the accelerating force has been reduced to zero. The moving mass is finally stopped and reversed in direction by the combined effect of the partial vacuum below and the air pressure above.

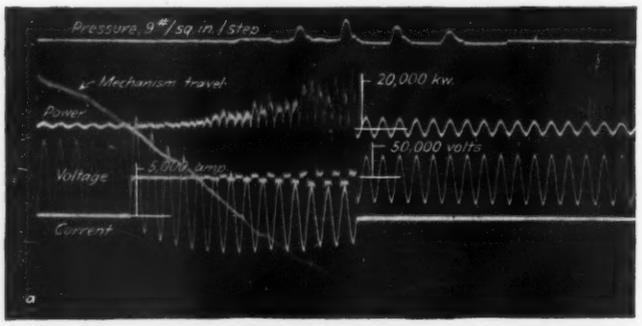
Instead of the usual conception of an expanding gas bubble which breaks its way through the oil surface

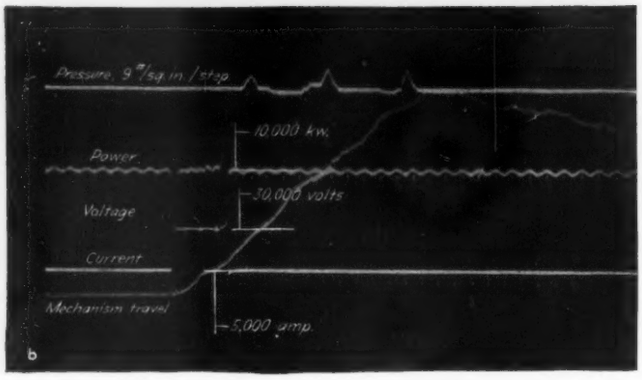
**A more complete discussion of these pressure waves may be found in "Pressure Phenomena in Oil Circuit Breakers," by W. M. Leeds, "Electric Journal," March, 1931.*

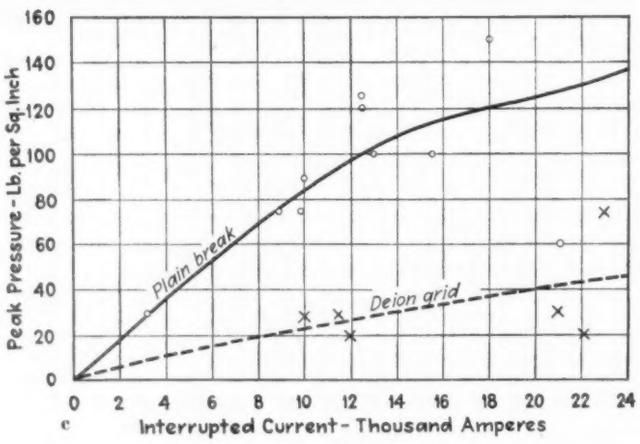
shortly after arc extinction we have, therefore, in the medium- and high-speed oil circuit breakers an oscillation of a mass of oil, continuing for a considerable number of cycles after the short circuit is cleared, resulting in a whole series of impacts on the circuit breaker tank. The greatest of these impacts is not always due to the first pressure impulse caused by the initial generation of gas during the arcing period, but may be caused by the sudden compression of the gas bubble by the rapidly descending oil mass immediately following the extinction of the arc with the ensuing collapse of the pressure beneath the oil piston.

Having established the fact that there are pressure waves generated in an oil circuit breaker set up by a surging mass of oil, it is worth while to consider what influence these pulsations may have on the circuit breaker operation. The breakdown voltage for gases at rest increases almost directly with pressure, and it might therefore be argued that if a pressure peak in the gas bubble caused by the returning oil mass should coincide with a current zero, the arc would have the most favorable opportunity of being extinguished. However, the examination of a large number of oscillograms of actual tests showed that there were just as many arcs extinguished at a current zero coinciding with a condition of low pressure as there were when the pressure was at a maximum. Evidently there is a more important factor than pressure that determines whether the arc should restrike or not.

This factor is believed to be the degree of turbulence of the medium between the contacts. Dielectric strength is recovered during a current zero by the loss of ions, either by direct recombination with ions of the opposite sign or by diffusion beyond the boundary of the arcing space, with or without the assistance of a gas blast. Since recombination in a cold gas takes place at a tremendously greater rate than in a hot gas, small volumes of fresh unionized gas and oil vapor turbulently mixed in the arcing area will form relatively cool centers of recombination, and thus greatly increase the rate of recovery of dielectric strength. The effect of the surging oil, therefore, can be beneficial only in so far as this condition of turbulence is augmented.







Figs. 5a, b, c—Deïon grid reduces maximum pressure

Interrupted current of 4,000 amp. at 38 kv. on a laboratory circuit having a very high rate of rise of recovery voltage. (a) Plain break breaker. (b) With Deïon grid. (c) 15-kv. Deïon grid breaker reduces pressure to one-third that with plain break.

Jumping due to recoil from bottom thrust

The opinion is prevalent that the mass of oil displaced by the expanding gas bubble may be thrown against the breaker cover with sufficient force to produce the observed jumping of oil circuit breakers. However, a careful investigation in the laboratory showed that a circuit breaker jumps before the oil has had time to reach the cover, and furthermore that the breaker frame is actually deflected downward at the first shock. Jumping is thus found to be due to the recoil of the tank and supporting structure following the impact on the bottom of the tank of an unbalanced downward force caused by a pressure surge from the gas bubble. The corresponding upward force is absorbed in accelerating the moving oil mass instead of exerting a pressure on the tank cover. Jumping of the breaker, therefore, is not always an indication of excessive arc energy or insufficient air cushion volume.

The arcing time of an oil circuit breaker may be considerably reduced by increasing the contact-opening speed. However, a limit is reached in ordinary circuit breakers at velocities in the neighborhood of 15 ft. per second, above which it is not desirable to go. Mechanical difficulties can be overcome by the use of trip-free lift rods, quick-break arcing contacts, or arc lengthening by magnetic blowout, but if this is carried too far the rate of arc energy liberation becomes so high that excessive pressures are built up in the oil. The solution of this difficulty is found in improving the interrupting efficiency of the oil circuit breaker by means of some device such as the Deïon grid, so that the required arc lengths may be reduced to a fraction of those required for plain-break arc rupture. This brings about a very great decrease in arc energy and makes it possible to take advantage of relatively high contact speeds without increasing the pressure values to be expected in the breaker.

The instantaneous pressure inside of a Deïon grid is

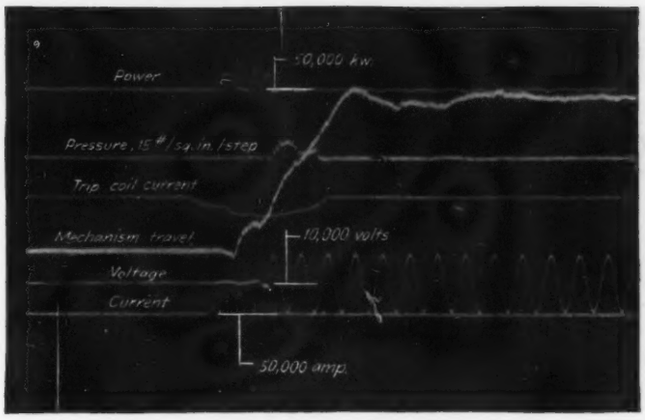


Fig. 6—Pressure stays low on 40,000-amp. short circuit
Five-kilovolt, single-phase fault imposed on station type breaker shows tank pressure of only 60 lb. per square inch.

many times that at the tank wall, but really destructive pressure values cannot be built up because of the free venting from the slot along one side. Although the arc is under the influence of a strong magnetic field which drives it back into oil pockets, where the deïonizing gas blast is generated, the arc cannot be lengthened as rapidly nor as much as would be the case in free oil because of the confining action of the slot walls in the grids. Since unnecessary arc lengthening is thus prevented, the rate of arc energy liberation, and therefore the magnitude of the pressure impulses, is kept down to a minimum.

Although the use of Deïon grids makes possible the interruption of an arc with only a fraction of the arc energy liberated when using plain breaks, because of the extremely short arc lengths required, it should not be assumed that the amplitude of the pressure pulsations will always be reduced in the same proportion. For example, Figs. 5 a and b show two oscillograms of a large oil circuit breaker opening about 4,000 amp. at 38 kv. across a single pole on a laboratory circuit having a very high rate of rise of recovery voltage, without and with Deïon grids. Although the Deïon grid arc energy was only about 5 per cent of the value obtained with plain breaks, the pressure peak was actually 45 lb. per square inch, as compared with 72 lb. per square inch with the plain-break contacts. This is explained by the fact that the rate of arc energy liberation, upon which the pressure rise depends, was nearly as low with the plain breaks as with the Deïon grids. The large gas generation with the plain breaks took place, therefore, slowly enough to allow expansion of the gas bubble without building up a high pressure.

Very high currents can be interrupted at high speeds with the Deïon grids without creating excessive pressures, either at the tank walls or within the grids themselves. The pressure impulses using Deïon grid contacts have in general only about one-third the value obtained with ordinary plain-break contacts.

Sustained or "static" pressures have been given little attention because they can only reach appreciable values when the total volume of generated gases is large in comparison with the normal air cushion volume. If the amount of energy liberation is small, as in a circuit breaker equipped with Deïon grids, the static pressure may be entirely neglected.

Although accurate prediction of pressure values to be expected under any given short-circuit conditions is difficult, the fact that the amplitude of the pressure pulsations depends upon the rate of energy liberation makes possible a better evaluation of the various factors entering into the problem. It is thus evident that extreme current asymmetry, very large oil head, excessive contact velocity or an unusually strong magnetic blowout field for arc-lengthening purposes will tend to build up high-pressure peaks in an oil circuit breaker. However, by the use of efficient deïonizing means which make possible the interruption of the circuit with a minimum length of arc, the importance of these factors may be greatly reduced.

Even though the current wave is asymmetrical, only a small amount of energy will be produced if the arc length, and therefore the arc voltage, is small. Low energy means low gas volume, making smaller oil heads practicable. Magnetic fields used only for the control of the arc as in the Deïon grids improve the performance without causing increased stresses. Finally, high contact velocities, if used with an efficient arc-rupturing device, may be employed with perfect safety to make possible reliable high-speed circuit breaker performance.

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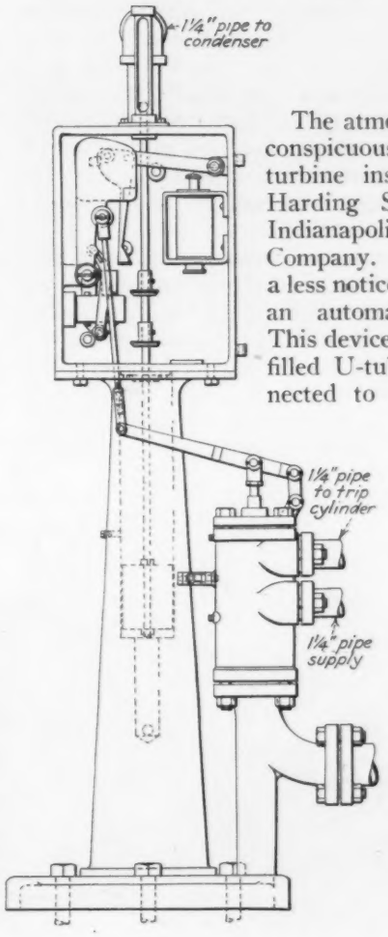
Atmospheric Relief Valve Eliminated



The atmospheric relief valve is conspicuous by its absence in the turbine installation of the new Harding Street station of the Indianapolis Power & Light Company. Its place is taken by a less noticeable apparatus termed an automatic vacuum tripper. This device consists of a mercury-filled U-tube with one side connected to the steam condenser. In the open leg of the tube floats a rod with collars so disposed on it that when the mercury level drops due to loss of vacuum in the condenser there is released a trigger whose action causes a valve to close in the turbine oil feed system. This, through the oil-pressure-controlled turbine throttle, shuts the unit down.

Reading Frequency Changers Installed Outdoors

By F. R. FORD
Assistant Engineer Inside Plant,
Philadelphia Electric Company, Philadelphia, Pa.

TO SUPPLY power for the railroad electrification program of the Reading Company under the twenty-year contract negotiated with the Philadelphia Electric Company, the latter company has installed initially a pair of 15,000-kw. frequency-converter sets. These are installed outdoors in a sheet-steel housing adjacent to the Wayne Junction passenger station, where two branch lines meet. This location was selected by the Reading Company as a desirable center from which to feed the various branches of its system. It is also a particularly good location for the frequency-converter substation, as it is within 2 miles of the Westmoreland substation of the Philadelphia Electric Company, which is at the center of its 66-kv. generating station tie system.

The substation is designed for an ultimate installation of six 15,000-kw., single-phase frequency-converter sets, of which two have been installed for initial operation. These sets were built by the Westinghouse Electric & Manufacturing Company and are rated 15,000 kw., 300 r.p.m. The generators are rated 13,270 volts, single phase, 25 cycles, 70 per cent power factor and the motors 18,000 kva., 13,600 volts, three phase, 90 per cent leading power factor. The sets are designed to carry 100 per cent overload swings momentarily and maintain normal generator terminal voltage.

In the case of a previous frequency-converter substation supplying another railroad electrification the sets were installed in a hollow tile building having a bridge crane, while the 60-cycle switching equipment is located outdoors. In approaching the design of Wayne Junction substation, however, it was felt that serious consideration should be given to locating the machines outdoors in view of the possible saving in installation cost, particularly for the initial step. The first thought was that the converter sets might be made hydrogen cooled, but it was concluded that the sealing problem was serious with a large multi-unit set and the operating cost would be too great to make such a design feasible from the economic standpoint. There would be no appreciable reduction in the windage losses through the use of hydrogen with such a low-speed machine.

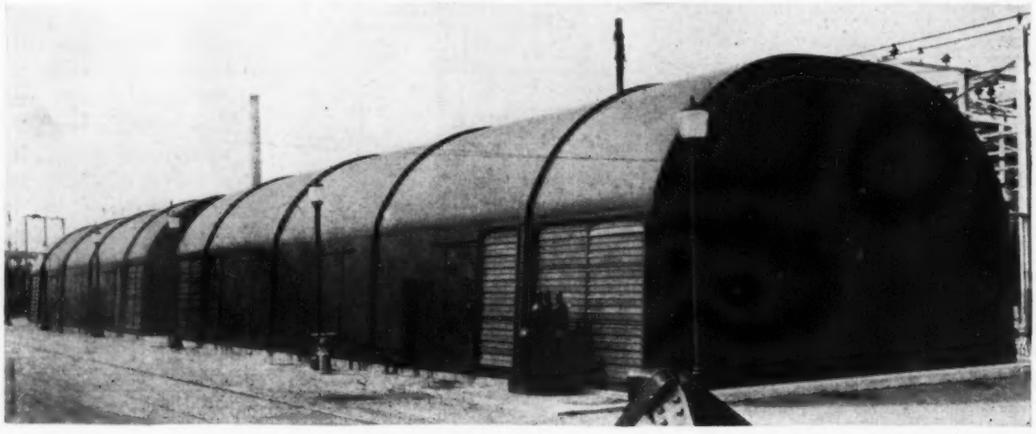
Outdoor scheme saves 6 per cent of cost

The manufacturers were then asked to prepare designs for air-cooled machines suitable for outdoor operation and as a result developed two alternate arrangements, one of which involved the use of a separate metal housing for each set and the other a housing which joined with the stator frames in an integral arrangement. The former design was felt to be much better as it permits ready access between the ends of the machine and the center bearings, thus facilitating inspection and maintenance as well as increasing the safety to personnel.

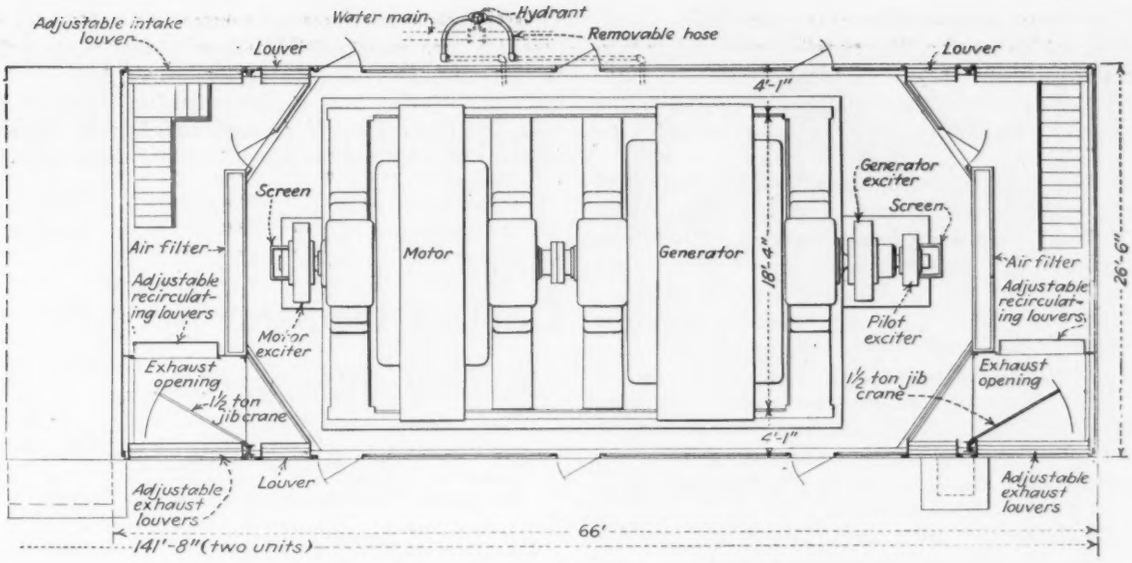
Comparative cost studies were made for both indoor and outdoor designs involving the use of various methods of handling the machines, such as a bridge crane, locomotive crane and hydraulic jacks. The principal designs considered with the comparative costs on the basis of a brick building with a bridge crane (the most expensive design) being unity are as follows:

	Relative Cost, Per Cent	Relative Land Area Required, Per Cent
Indoor machines, outdoor switching		
(*a*) High brick building and bridge crane	100	100
(*b*) High brick building and locomotive crane	97	100
Indoor machines, outdoor switching, low brick building. Machines handled by jacks	95	100
Outdoor machines, outdoor switching, Machines handled by jacks	94	172

The fact that lowest cost was indicated for the outdoor machines, coupled with a desire to gain experience with this type of equipment as a forerunner to future

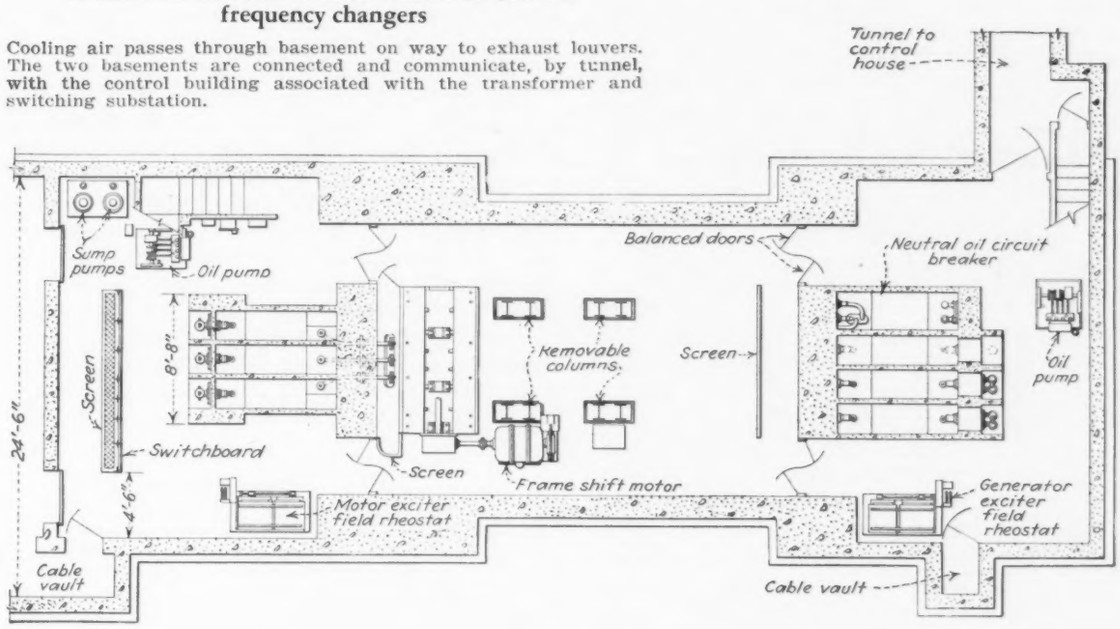


Sheet steel shelters two frequency converters



Auxiliaries and cables in basement of outdoor frequency changers

Cooling air passes through basement on way to exhaust louvers. The two basements are connected and communicate, by tunnel, with the control building associated with the transformer and switching substation.



installations which may most economically be made outdoors, led to the decision to install the outdoor sets with the separate housings.

Consideration was given to the desirability of installing some type of air-cleaning equipment in view of the location of the substation at a point between two branches of the railroad. Closed circuit cooling was not practicable due to the lack of a reliable water supply. It was believed that the decreased frequency of inspection and cleaning which would be followed with filtered air would justify the cost of filters and resulted in a decision to install such equipment.

Air intakes are located at both ends of one side of the housing and the discharge is on the opposite side. The path of the air from the end compartments is through the air filters and into the machine, entering both the motor and generator from each side with the discharge into the basement. From the basement the air travels through uptake passageways to the discharge louvers. A recirculation louver is provided between the intake compartment and discharge passage to permit of tempering the air to the machine in cold weather if desired.

Interchange of heat prevents condensation

While there is a barrier wall between the basement of adjacent units, the doors are normally open and condensation in an idle machine is prevented by the circulation through it of some of the discharge air from an operating machine. If this feature is not found to be entirely satisfactory, electric space heaters can also be used.

The equipment in the machine basements includes compartments housing 13,200-volt leads, disconnecting switches, instrument transformers and a neutral oil circuit breaker, frame-shifting motor and control, field breakers, rheostats and control, high-pressure bearing oil pumps and control and automatic sump pump motors.

In addition to the basement doors between units, doors have been provided at the far ends of the motor and generator stator frames. All of these doors are automatically closed upon operation of the differential relays so as to confine the results of a failure as much as possible.

The machine housings are made from rolled steel sheets with interior roof bracing and are arranged in five longitudinal sections bolted together through a suitable weathertight construction. Three doors are provided in each side of the housing and, in addition, access to the machines from the control building is available through an underground passageway.

For handling bearing parts and other items on the machine floor monorail cranes have been provided capable of lifting 1½ tons. Equipment can be moved into or out of the basement through removal of a set of discharge louvers and the use of a jib crane located in the upper part of a discharge shaft.

For any maintenance operations beyond the capacity of the monorail cranes or when removal of a large part from the housing is necessary the upper part of a housing section can be readily removed and a railroad crane utilized

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A New Spirit in Business*

By H. P. LIVERSIDGE
Vice-President and General Manager
Philadelphia Electric Company

We are entering upon a new era of business in which the wastes and the extravagances of distribution and sales must be minimized, an era that will require greater co-operation, better understanding and a saner appreciation of the disastrous effects of destructive competition. These fundamentals are becoming more clearly recognized by business generally, but their broad application in practice still leaves much to be desired. For example, selfish motives of individual units, domination by the more influential interests, always throw difficulties in the way of real progress through co-operative methods.

Back in the '90s it was the accepted practice for every merchant to disparage the other man's merchandise in order to sell his own. Experience has taught that race of merchants, once and for all, that in the long run goods could not be sold that way. For in tearing down faith in the other man's products this 1890 merchant undermined confidence in his own. He injured the whole cause of that industry and defeated the very purpose for which he had set himself up in business.

Those definitely destructive days I know we have left forever. They were the days of the sin of *commission!* Today, although we have come far away from these practices, some of us in business commit another sin. Let us call it the sin of omission—not what we *do* but what we *do not* do. Business men in many lines are still under the impression that they cannot actively help those in the same industry except at the cost of their own advancement. They have not yet come to that point of view, so clear to those who have once achieved it, that any aid, inspiration or direction given to an individual in the same trade or industry is a direct aid given to that industry itself. For as the individual prospers, so the industry prospers. If enough individuals become successful in any industry you cannot keep that industry down.

*Excerpts from address commemorating new headquarters of Philadelphia Electric Association and permanent lighting exhibit.

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Contact Demand Records Quickly Interpreted

By W. E. CHRISTNAGEL
Minnesota Power & Light Company, Little Falls, Minn.

Frequent need for the determinations of customer load peaks in meter and service inspection work requires their recurrent arithmetical calculations when the data are taken from General Electric type G-9 graphic demand meters. These instruments are simply impulse recorders whose activations proceed from contacts mechanically related to the shafts of watt-hour meters and are not, of themselves, measures of any electrical quantity. Each division on the recorder chart represents a definite increment of electrical load according to the conditions of the meter installation with which the demand instrument is associated. To avoid the otherwise necessary arithmetic for arriving at the values of load peaks shown on these records, the writer uses a chart like the one reproduced here and from which the peaks on the records may be read directly. This particular chart is set up for a demand instrument used with a 5-amp., 110-volt watt-hour meter on whose shaft is a four-pitch worm operating a five-point cam. Each division of the 100 division,

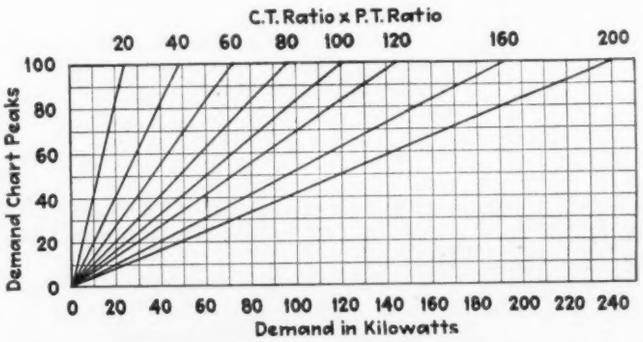


Chart reads demand peaks directly

Equation is $Kw. = C.T.2 \times P.T.R. \times$ Peak reading × contact constant between demand instrument and watt-hour meter. In this case the contact constant is 0.012. The chart may be extended to include higher products of instrument transformer ratios or revised for any other contact constant.

No. 1072-A, chart thus represents 0.012 kw. multiplied by the ratios of the current and potential transformers used. The procedure is to start on the line corresponding to the product of the transformer ratios, move to its intersection with the horizontal line of the peak shown on the chart and then descend vertically to the kw. result on the x axis.

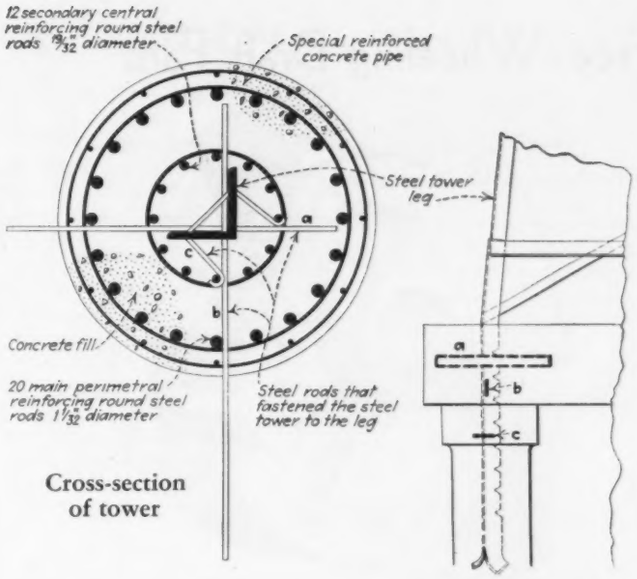
Italian Tower Line Crosses Lake for 2 Miles

IN CONSTRUCTING the 60-kv. double-circuit steel tower transmission line of the Italian State Railway between Torre del Lago and Vaioni (Italy) some unusual problems were encountered and solved. According to Boncori Lamberto, engineer on the project, the decision to have the line cross Lake Massaciuccoli for a distance of some 10,650 ft. necessitated development of an economical, strong type of tower foundation which could be placed without complicated construction aids and overcome the difficulty presented by the peat and sand forming the lake's bottom. The foundation adopted consists of a reinforced concrete frame with four cylindrical legs, one for each leg of the tower. These members were connected at the top by a framework and diagonals of reinforced-concrete construction.

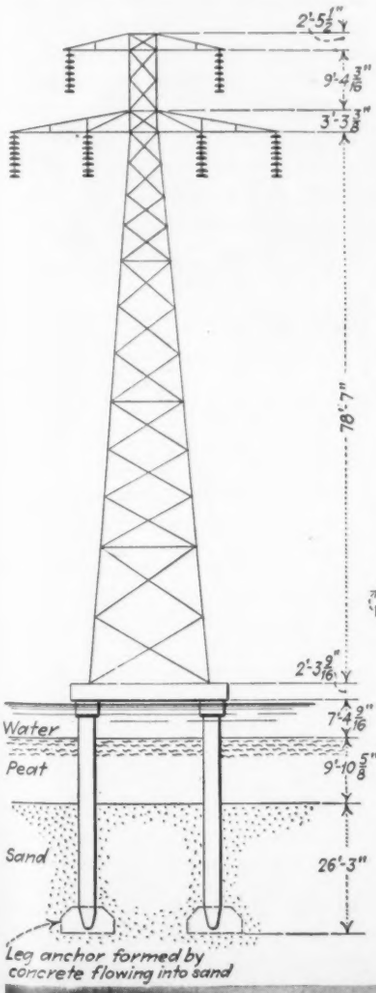
Each leg, about 44 ft. in length, was built by, first, sinking reinforced concrete pipe sections 27½ in. in outer diameter and 10 ft. long, by evacuating, with a special trap-bottom bucket hoist, the inner space resting progressively on the lake bottom and forcing down the pipe sections by the weight of a superimposed platform loaded with sand-filled bags; second, a reinforcing framework of twenty perimetral round steel rods $1\frac{1}{32}$ in. in diameter and twelve secondary central round steel rods $\frac{19}{32}$ in. in diameter was inserted inside the sunken pipes; third, the evacuated space was pumped dry, and, fourth, filled with concrete.

The crossing consists of twelve spans, of which ten are 1,000 ft. and two are 860 ft. The towers are 93 ft. high. The transmission line is operated 60 kv., but is designed for 130 kv. service.

According to Signor Lamberto, other reasons besides those of convenience in construction dictated the method of installing the base. Had the leg columns been forced down by a pile driver, injury to the reinforced-concrete structure might have formed small crevices, permitting the infiltration of water and consequent slow disintegration of the reinforcing, causing progressive weakening of the whole structure. The cost of the foundation for each tower was about 1,610 lira, or $84.75, he said.

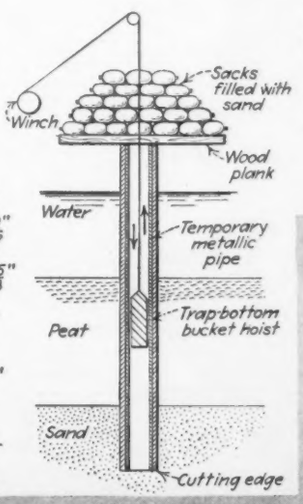

12 secondary central reinforcing round steel rods 19/32" diameter
Special reinforced concrete pipe
Steel tower leg
Concrete fill
20 main perimetral reinforcing round steel rods 1 1/32" diameter
Steel rods that fastened the steel tower to the leg
a
b
c

Cross-section of tower



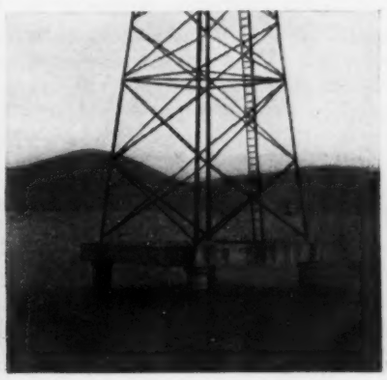
Steel tower and foundation

How the hollow pipes were sunk

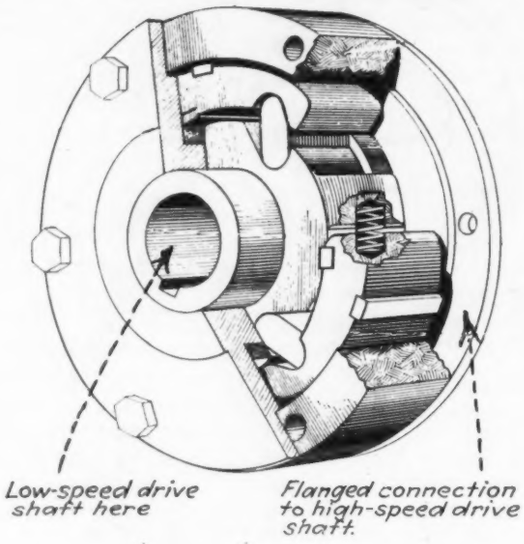


Towers on Italian line which crosses 2 miles of open water

A typical mid-lake tower base



Free-Wheeling Draft Fans



On draft fans driven at high and low speeds by separate motors there is the possibility, more or less remote according to the quality of engineering in an installation, that the high-speed motor may be seriously overloaded if it runs while the low-speed drive is still connected. The low-speed motor then acts as an induction generator and may, if it is large enough, cause serious disturbance in the electricity supply system. To increase further the remoteness of this possibility the Management & Engineering Corporation specified Pitter one-way clutches between low-speed motors and draft fans in the New Harding Street station of the Indianapolis Power & Light Company. These clutches are installed in addition to the usual electrical and mechanical interlocks between the controls of the double motor fan drives.

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READERS' FORUM

Sunrise Interruptions

To the Editor of the ELECTRICAL WORLD:

Since the publication of our article on sunrise interruptions in the ELECTRICAL WORLD of October 10 we have been interested in letters on this subject published in the ELECTRICAL WORLD, as well as in correspondence received. While a plausible case may be made for almost any of the various suggested causes of sunrise interruptions, we are as yet unable to accept any of the explanations as a proved major cause.

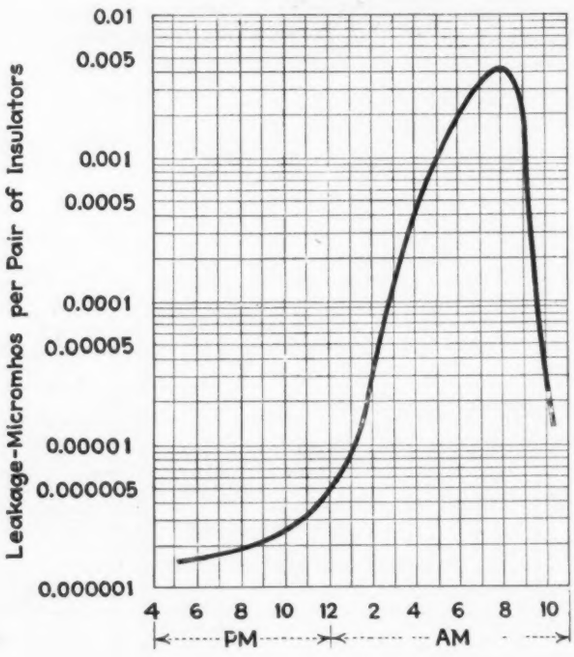
As for the possibility of increased expansion (due to heat from the rising sun) reducing clearance and causing flashovers due to uplift, I would say that most of our lines have a factor of safety so high under wind and ice loadings that they could not give much trouble in this regard. Furthermore, a sunrise flashover on August 16, 1931, was witnessed and known to have occurred in level country where the sag was uniform and the line was on a tangent (horizontal configuration). Another sunrise flashover occurred on November 1, 1931, on a hillside in the residential section of Missionary Ridge, where the towers are less than 100 yd. apart and on a tangent (vertical configuration).

As sunrise in this latitude advances westward about 4 miles per minute, this rate of travel, if it could heat the conductors fast enough, might cause considerable movement of the conductors, or, at least, unequal strains on them.

If the effect is of the nature suggested in Mr. Hill's letter (published in the issue of December 5), lines at right angles to the direction of sunrise or in level country ought to be immune from sunrise interruptions, but this does not seem to be the case on our system.

A prominent foreign engineer has suggested that sunrise flashovers are due to sudden changes in the vertical potential gradient caused by ionization of the Heaviside layer by sunrise, similar to sunrise changes in radio reception and magnetic storms. That is, under varying weather conditions a potential gradient may exist between the earth and the upper atmosphere, similar to that in lightning storms, but of less intensity. This should be capable of being measured experimentally. Combined with excessive vibration, unusual leakage, or some other abnormal condition, flashovers might easily result.

The heavy leakage occurring near sunrise has been mentioned by Mr. Rowe (in the issue of November 28), and the amount of the increase in leakage is well illustrated by the attached curve of leakage on a telephone line. This curve is taken from the *Bell System Technical Journal* and is published with the kind permission of L. T. Wilson, of the A. T. & T. Company. The data was taken in Texas late in November when sunrise occurred close to 7 a.m. It will be noted that leakage increased over 3,000 times from 5 p.m. until 7 a.m. Most likely this effect is probably pronounced when a heavy dew or light rain occurs after a long, dry period and the insulators are covered with dust.



E. E. GEORGE.

Tennessee Electric Power Company.

Men of the Industry

C. A. Leland Takes Over Management of Kansas Properties

C. A. LELAND, JR., vice-president and general manager of the Des Moines Electric Light Company and the Des Moines Gas Company, will take charge of the Kansas utility properties of the

North American Light & Power Company to succeed the late Albert Patten of Topeka. It has been announced that in taking over the Kansas properties Mr. Leland will retain supervision of the Iowa holdings of the North American company and will handle the duties of his Kansas position from Des Moines.

A native of El Dorado, Kan., and a graduate of Kansas University, he was first identified with industrial enterprises before he entered the public utility field with the Atchison Railway, Light & Power Company. After the war he went at first to Atchison and then to Topeka to direct construction of the Tecumseh power plant. Later he became general manager of the United Light & Power Company of Kansas, and in 1927 he assumed the duties of vice-president and general manager of the Des Moines Electric Light Company and the Iowa Power & Light Company. When the Des Moines Gas Company was consolidated with these companies he became vice-president and general manager of this company also.

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M. W. THERNES has been appointed secretary-treasurer of the Ohio Public Service Company to fill the vacancy caused by the resignation of R. E. Cuthbertson. Mr. Thernes has been identified with the Doherty organization since 1917, when he entered the employ of the Fremont Gas, Electric Light & Power Company, Fremont, Neb. During his period of service with that company he advanced from bookkeeper, cashier, assistant secretary to the position of secretary. When the electric division of the company was sold Mr. Thernes was transferred, in 1922, as secretary for the Spokane Gas & Fuel Company, where he remained until the spring of 1930, when he was transferred as secretary to the Minneapolis office of the securities department.

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Roy Page Assumes New Executive Duties

ROY PAGE, vice-president and general manager of the Nebraska Power Company, Omaha, has been elected vice-president of the Citizens' Power & Light Company of Council Bluffs, Iowa. A graduate of the University of California, he joined the Nebraska Power Company in 1917 as assistant to the vice-president. Later he was named general superintendent and in 1922 he became assistant general manager. It was from this position that he advanced in 1930 to become general manager and a few months later vice-president.

Mr. Page has been active in civic affairs in Omaha and in representative associations, having served at president of the Nebraska Section of the National Electric Light Association and also as chairman of the engineering section of the Middle West Division.

Z. E. Merrill Named Vice-President of Oregon Utility

Z. E. MERRILL, who was elected vice-president in charge of operation of the Mountain States Power Company, Albany, Ore., brings to his new executive position extensive experience in the

operation of public utility properties in the West. After receiving his technical training at the College of Engineering of the University of Wisconsin, he entered the employ of the Milwaukee Electric Railway & Light Company, but removed a year later to Spokane, Wash., where he joined the Washington Water Power Company.

For a number of years Mr. Merrill was employed as manager of the Republic Light & Power Company and also as manager of the Washington Northern Telephone & Telegraph Company at Republic, Wash., and was for two years of this time a part owner of the two properties. Then he became assistant electrical engineer of the United States Reclamation Service at Denver, Colo. Following discharge from military service Mr. Merrill was employed in March, 1919, as assistant engineer by the Public Service Commission of the State of Washington. He left this position to accept the position of operating superintendent of the Wenatchee Valley Gas & Elecric Company, then in receivership. He remained on this property until February, 1923, when he resigned to become assistant general manager of the Mountain States Power Company with headquarters at Albany, Ore. He has been with that utility continuously except for a period of eight months in 1930 and 1931, when located in New York City.

E. P. Gosling Heads Laclede Utility

E. P. GOSLING, vice-president and general manager of the Laclede Power & Light Company, has been elected president of the Laclede Gas Light Company, which controls the power and light company, to succeed George B. Evans, whose resignation becomes effective January 1. Mr. Evans was named president of the Laclede Gas Company in 1925. Mr. Gosling went to St. Louis in 1930 to assume the duties of vice-president and general manager of the light and power company. He had been vice-president and general manager of the Newport Electric Corporation at Newport, R. I., which is controlled by the Utilities Power & Light Corporation, the parent corporation of the Laclede Gas Light Company. He has been engaged in public utility work for about 40 years and since 1903 has held various managerial jobs.

Mr. Evans joined the Laclede company as a structural engineer in 1903 and with the exception of two years devoted to consultation work he has been with the company since that time. He is a graduate of Wisconsin University.

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DEANE E. ACKERS of Topeka, general manager of the Kansas Power & Light Company, has been appointed vice-president of that company.

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E. D. BELL has been elected vice-president of the United Power & Light Corporation of Kansas and will continue in operating charge of the United Power & Light group. His former title was general manager.

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HARLEIGH H. HARTMAN has resigned as a member of the Public Utilities Commission of the District of Columbia, according to an announcement made by Mason M. Patrick, chairman of the commission. For the present Mr. Hartman will remain in Washington to continue his duties as professor at the Washington College of Law.

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OBITUARY

JOHN E. POINGDESTRE, pioneer in hydro-electric development in northern California, died recently, in his eighty-fourth year. He was a native of the Channel Islands, a British possession, received his education in France and Austria and went to California at the age of 30. He invested in farming and mining enterprises and in 1894 he entered the employ of the newly organized Nevada County Power Company. After serving in the Nevada City office he was transferred to Grass Valley as manager and held that position until 1905, when he was sent to take charge of the California Gas & Electric Corporation's business at Redwood City. In 1906, following the merger of that company with the Pacific Gas & Electric Company, he was transferred to Marysville. In 1918 he was retired from service.

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MYRON MCNEAL, 43 years of age, veteran district and division manager for the Southern California Edison Company, Ltd., died December 18, at the Good Samaritan Hospital, Los Angeles, following an illness of less than a week. Joining the Edison organization in 1910, Mr. McNeal first was associated with the Monrovia district office and later with the Los Angeles district. In 1921 he became assistant district manager at Long Beach, and the following year he was appointed manager of the Montebello district. Later Mr. McNeal was made manager also of the Vernon district. Last year he was appointed manager of the central division, being given the supervision of the Montebello, Vernon, Compton, Alhambra and Pasadena districts. Born in Denver, Colo., Mr. McNeal attended the public schools and studied at college there. He removed to California in 1910.

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WILLIAM B. DUNCAN, assistant professor of electrical engineering at Leland Stanford University, died, of pneumonia, December 18, at the age of 33. Professor Duncan joined the faculty after he received his electrical engineering degree in 1927. Besides his academic work, he carried on research in lightning protection for several large oil companies and had been successful in planning and executing protective measures for many tank farms on the Pacific Coast.

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WILLIAM B. MATHEWS, pioneer figure in the water-development program of Los Angeles, Calif., and chief counsel for the Metropolitan Water District of Southern California, died December 9, in Los Angeles. He was 66 years of age. In 1907, after seven years as Los Angeles city attorney, Mr. Mathews was appointed special counsel for the Los Angeles aqueduct bureau and directed the legal phases of the city's water development in the Owens River Valley. With the close of the bureau's work, in 1913, he became special counsel for the Los Angeles water and power department and continued in that capacity until 1929, when he was appointed chief counsel for the Metropolitan Water District. He had taken a prominent part in framing the legislative enabling act under which the district was formed, and likewise was recognized as a leader in southern California efforts looking toward the solution of state-wide water problems and the construction of Hoover Dam. He was a member of the California Colorado River Commission and the California Water Resources Commission. Born in Georgetown, Ohio, March 1, 1865, Mr. Mathews spent his boyhood and received his early education across the river in Maysville, Ky. He was graduated from Centre College in 1885 and from the law school of Columbia University two years later. He was admitted to the Kentucky state bar in 1888 and began the practice of law in Los Angeles, Calif., the following year. He was the senior member of the law firm of Mathews, Bordwell and Wadsworth.

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FRANK H. MARTIN, engineer, who was prominently identified with some important hydro-electric and industrial engineering projects in Canada, the United States and Brazil, died in Winnipeg, December 17, in his fifty-first year. Mr. Martin obtained his early training with the Dexter Folder Company of Pearl River, N. Y.; the American Smelting & Refining Company, Perth Amboy, N. J., and as engineering draftsman with various companies until 1905. For a time he was in charge of the technical department of the Rio de Janeiro Tramway, Light & Power Company in Brazil. From 1906 to 1909 he was chief draftsman for the Electric Development Company of Ontario and later was associated with the F. S. Pearson Engineering Company, Ontario Power Company and Toronto Power Company in the designing, construction, installation and operation of hydro-electric plants. For some years he was president and chief engineer of the Martin Engineering Corporation of Niagara Falls, and later removed to Winnipeg, where he designed the Great Falls plant of the Manitoba Power Company. Subsequently he was appointed chief engineer of design and construction for the Northwestern Power Company and in this capacity he directed the completion of the initial development of the Seven Sisters plant on the Winnipeg River. At the time of his death he was consulting engineer for various companies.

Financial and Statistical News

STOCK market operations settled down into narrow limits after new low prices were reached in all groups last week. Thirty-seven utility stocks now average 36.5, a new low point for at least six years. In this group holding company stocks now average but one-third of their high for the year, while the operating company average is 42 per cent below the high point.

——POWER AND LIGHT BONDS AGAIN OFFERED FURTHER RESISTANCE to the selling trend and averages are up slightly from last week. Year-end computations indicate power and light revenues are less than 1 per cent below last year's totals, although energy output is around 4 per cent under the 1930 figure.

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Wisconsin Commission Changes Boscobel Rates

AN ORDER HAS BEEN ISSUED by the Public Service Commission of Wisconsin revising the electrical rates of the municipal utility in the city of Boscobel so as to require a service charge of $1 for both residential and commercial service and a service charge of 40 cents per horsepower of connected load per month for power service. This is in line with the policy recently adopted by this commission of requiring rate schedules which will benefit the regular user of electricity and not discriminate against him in favor of the casual user.

The opinion of the commission points out why such a service charge or, as it might perhaps be called, "customer's expense charge" should be imposed. As a result of the application of such a charge the energy rates in this utility plant have been very substantially cut; for example, residential service, in which the first step was formerly 11 cents for the first 30 kw.-hr., has been cut to 5 cents for the first 20 kw.-hr.

The commission in this case has disapproved the minimum bill of $1.25 per month formerly in effect, since it developed that 34.1 per cent of the total bills issued were for the minimum bill.

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Gain in Energy Sales to Residence Customers

DESPITE A DECREASE in total sales of electricity during the first ten months of 1931, sales of energy per residential customer by subsidiaries of the Central & South West Utilities Company for this period are running 6.5 per cent ahead of sales for the first ten months of 1930, according to figures announced today by James C. Kennedy, president of the company.

Sales per residential customer for October, 1931, showed a gain of 7 per cent over October of last year. Sales to this class of customer represent approximately 13 per cent of total sales to all customers.

Sales of electricity per commercial lighting customer increased 4 per cent for the first ten months over the corresponding period in 1930, while sales for October gained 5 per cent over October, 1930. Commercial lighting sales also represent approximately 13 per cent of total sales. Total sales to all other types of customers were off for both October and the ten-months period.

The residential gains, Mr. Kennedy pointed out, were due to the increased use of electric refrigerators, ranges and other electric appliances in the home. Commercial lighting gains were due partially to the added use of electricity for floodlighting buildings, athletic contests, etc.

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Green Mountain Power Elects Directorate

GREEN MOUNTAIN POWER CORPORATION, Bellows Falls, Vt., acquired recently by the New England Power Association, Boston, Mass., has elected the following new board of directors: Roy L. Patrick, Burlington, Vt.; Fred A. Howland, Montpelier, Vt.; Frank E. Langley, Barre, Vt.; Homer L. Skeels, Montpelier; Ralph N. Hill, Burlington; and Frank D. Comerford, Carl S. Herrmann, Arthur E. Pope and Frederick J. Dunn, all of Boston, Mass.

Following the election the directors declared the regular quarterly dividend of $1.50 a share on preferred stock payable December 21 to stockholders of record December 9. The dividend is usually scheduled for payment December 1, but was delayed because of financial difficulties of the former owners.

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Stone & Webster Group Realign Affiliates

FURTHER progress has been made in the realignment of the various units in the Stone & Webster corporate structure announced in these columns recently. Certain holding companies whose functions had disappeared have been dropped, a portion of investments have been sold and more independence apparently exists between the various management, engineering and banking affiliates.

It will be recalled that in 1930 Engineers Public Service Company became a direct subsidiary of Stone & Webster, Inc., through an exchange of stock. Stone & Webster Associates Corporation and Stone & Webster Investing Corporation were eliminated. The next step in the process was the writing down of the capital of Stone & Webster Service Corporation from $300,000 to $100,000. This company is now qualified to do business in New York and its operations are being gradually expanded.

The result of all this is that Stone & Webster, Inc., is now a holding company for Engineers Public Service Company, Stone & Webster Engineering Company, Stone & Webster and Blodget, Inc., Stone & Webster Service Corporation and the Sierra Pacific Electric Company. At the same time the various units are granted virtually complete autonomy, with final decisions, of course, resting with the parent company. This same policy is followed in general throughout the entire organization. Local managers in the Engineers Public Service System, for example, are granted a maximum of autonomy. Stone & Webster, Inc., has recently increased its holdings in Stone & Webster and Blodget from 66 to 84 per cent.

Weekly Energy Output

WEEKLY ENERGY OUTPUT by central stations for light and power, as reported by the National Electric Light Association, was as follows:

	1931	1930	1929	1928
November 14...	1,633	1,713	1,794	1,696
November 21...	1,655	1,722	1,818	1,701
November 28...	1,600	1,672	1,718	1,619
December 5...	1,671	1,747	1,806	1,706
December 12...	1,672	1,748	1,841	1,716
December 19...	1,676	1,770	1,860	1,710

The output continues somewhat less than it was a year ago; during the first three weeks of December it fell short, successively, by 4.3, 4.4 and 5.3 per cent.

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British Electric Consumption Triumphs Over Depression

DESPITE THE SERIOUS INCREASE in unemployment in the basic industries of the United Kingdom, the output and consumption of electricity in the country continues to increase, a decline in the production of industrial power being offset by increased domestic use. The eleventh annual report, just issued by the Electricity Commission, covering the year ended March 31 last, states that the curtailment of production and lessening of industrial activity rendered it difficult in some cases for authorized undertakers to maintain their output at the level of the previous year. In other cases there was an actual decrease in output.

"In the difficult circumstances," states the report, "it must be regarded as a satisfactory achievement that the electricity supply industry was able, with the aid of an increasing domestic load, to record a net increase in output (units generated) during the year of as much as 545,000,000 units, representing a growth of upward of 5 per cent on the output in the previous year."

The principal districts recording the decreases were those of northeast England and central Scotland. Increases were obtained in the remaining English regional areas and in north Scotland.

In spite of the effect of the uncertain outlook, the commissioners record there was no general curtailment, or even slowing down, of development by the electricity industry. On the contrary, the regional ("grid") schemes and many other approved transmission and distribution projects were pressed forward, a considerable number of them being undertaken in advance of normal development for the express purpose of relieving unemployment.

Since 1926, the year of the general strike, the comparative consumption figures have been, in kw.-hr.: 1927, 6,850,000,000; 1928, 7,603,000,000; 1929, 8,596,000,000; 1930, 9,029,000,000.

The revenue received by authorized undertakers in Britain in the year ended December 31, 1930, was £52,209,460 ($254,000,000). This compares with £49,981,386 ($243,000,000) in 1929.

The aggregate capacity of the generating plant for new stations and extensions of existing stations sanctioned by the commission during the year 1930-31 amounted to 892,249 kw., as compared with 292,838 kw. in the preceding year; and an annual average of upward of 500,00 kw. during the past ten years.

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Residential Business Gains 12.6 per Cent

THAT THERE ARE LARGE AREAS over which the energy output this year is greater than it was a year ago and that the increase applies, in varying degree, to all classes of consumers is evident from a report of operations of the Middle West Utilities System for October and for the first ten months of 1931.

Excluding new companies acquired during the year, residential consumption in October was 12.6 per cent greater, commercial power 9.1 per cent and total output 6.7 per cent greater than in 1930. Including additions residential sales increased 14.8 per cent and total output 9.2 per cent.

Energy Output—Middle West Utilities System

	October, 1931 (Excluding New Companies) Kilowatt-Hours	Increase, Per Cent	October, 1931 (Including New Companies) Kilowatt-Hours	Increase, Per Cent	October, 1930 Kilowatt-Hours
Residential	44,284,000	12.6	45,165,000	14.8	39,336,000
Commercial lighting	34,230,000	4.2	34,813,000	6.0	32,839,000
Commercial power	157,270,000	9.1	159,866,000	10.9	144,091,000
All other	171,588,000	3.6	177,068,000	6.9	165,663,000
Total output	407,372,000	6.7	416,912,000	9.2	381,929,000
	First Ten Months 1931 (Excluding New Companies) Kilowatt-Hours	Increase, Per Cent	First Ten Months 1931 (Including New Companies) Kilowatt-Hours	Increase, Per Cent	First Ten Months 1930 Kilowatt-Hours
Residential	415,900,000	11.8	423,297,000	13.8	372,068,000
Commercial lighting	324,233,000	4.5	330,424,000	6.5	310,189,000
Commercial power	1,458,217,000	5.9	1,488,087,000	8.0	1,377,593,000
All other	1,512,080,000	1.1	1,568,607,000	2.2	1,496,087,000
Total output	3,710,430,000	4.5	3,810,415,000	6.0	3,555,939,000

Columbia Gas & Electric Will Pay Stock Dividend

ANOTHER OF THE LARGE utility systems inaugurates the payment of dividends in stock. To conserve cash, directors of Columbia Gas & Electric Corporation have voted to substitute stock dividends for a limited time on the common stock in place of the present cash dividend.

The stock dividends will be paid in convertible 5 per cent preference stock, junior to the existing preferred stock, and will be continued only until conditions in the security markets indicate the wisdom of financing through sale of securities and the resumption of cash dividends. The corporation has called a special meeting of stockholders for January 14, to approve authorization of an issue of 250,000 shares of convertible 5 per cent cumulative preference stock. the first quarterly dividend in preferred stock on the common stock will be payable February 15 and will be at the annual rate of $1.50, the current cash rate.

Stock which may be issued for dividend purposes will be convertible at the option of the holder at any time within five years after February 15, 1932, into common stock of Columbia Gas & Electric Corporation on a basis of $20 a share of common stock—that is, at the rate of one share of preference stock for five shares of common stock.

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Daily Output Declines

INSTEAD OF THE NORMAL seasonal increase the average daily energy output of public utility power plants in October was about 1 per cent less than in September, although the total output increased from 7,530,000,000 kw.-hr. to 7,708,000,000 kw.-hr., it is reported by the Geological Survey. Compared with 1930, the October total is down 6 per cent, against 3 per cent for September and 4 per cent for August.

The only regional exception to the general shrinkage is found in the South Atlantic states, where the output was 1 per cent greater than last year.

The decrease is the largest since February; as will appear from the table, the output first fell below that of the corresponding month of the preceding year in July, 1930.

The energy generated from water power in October was only 26 per cent of the total amount generated by both water and fuel power. This percentage is the lowest since 1919, when the Geological Survey started publication of statistics showing the monthly production of electricity. The maximum percentage of 46 was reached in May, 1928.

There has been an increase of about 40 per cent in the capacity of waterwheels installed in public utility power plants since 1926, and the capacity could now produce more than four times the output from water power in October. These figures, the Survey points out, indicate the effect of the drought, which has continued for about two years.

A sudden change from the present condition of deficient precipitation to one of excessive precipitation would undoubtedly bring about a large increase in hydro-electric output and would have a decided effect on the demand for fuel by electric power utilities.

Per Cent Change in Output

Month	1930-1931	1929-1930	Month	1930-1931	1929-1930
January...	—8	+5	July.....	—2	—2
February..	—6	+3	August...	—4	—5
March....	—4	+2	September	—3	—3
April.....	—5	+2	October...	—6	—6
May.....	—3	0	November	...	—7
June.....	—2	0	December	...	—5

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Standard Gas System Will Spend $25,000,000

THE PRELIMINARY CONSTRUCTION BUDGET of the Standard Gas & Electric Company for 1932 will total $25,015,966, according to John J. O'Brien, president of the company. Projects now under construction at properties in the Standard Gas & Electric Company system amounting to $3,508,034 will not be completed during 1931, costs for which are included in the preliminary burget figures set up for 1932. Unfinished construction during 1931 includes the Prospect diversion project of the California Oregon Power Company system, which will not be placed in service until 1932.

The total preliminary budget expenditure for 1932 may be segregated as follows: Electric department, $16,347,300; gas department, $3,319,809, and other departments, including general construction, $5,338,857.

It is proposed that the preliminary budget of $25,015,966 be expended by subsidiary and affiliated companies comprising the Standard Gas & Electric Company system in the following amounts:

California Oregon Power Company	$1,097,394
Kentucky-West Virginia Gas Company	893,298
Louisville Gas & Electric Company	1,381,130
Market Street Railway Company	441,607
Mexican Public Service Company	52,544
Mountain States Power Company	615,088
Northern States Power Company	5,650,242
Oklahoma Gas and Electric Company	1,573,496
Philadelphia Company	10,881,807
San Diego Consolidated Gas & Electric Company	890,939
Southern Colorado Power Company	158,016
Wisconsin Public Service Corporation	847,566
Wisconsin Valley Electric Company	532,839
Total	$25,015,966

Engineering and construction services for these projects will be rendered by Byllesby Engineering & Management Corporation, the wholly owned subsidiary of Standard Gas & Electric Company.

The total installed steam and electric generating capacity in the Standard Gas system is now 1,539,477 kw. The Standard Gas & Electric Company system now serves 1,658 communities having a combined population of 6,000,000 located in twenty states.

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American & Foreign Power Net Down 25 per Cent

NET INCOME OF American & Foreign Power Company for the year ended September 30 amounted to $19,428,495 after charges, taxes, and depreciation, against $26,002,077 for the previous year.

Gross revenues of operating subsidiaries were $69,458,189, against $77,351,407 the year before, and net earnings were $35,428,605, compared with $38,606,501. Total income was $37,907,839, against $41,623,244, and balance to parent company after depreciation, subsidiary interest and preferred dividends and minority interest was $27,107,720, contrasted with $30,369,010. Total income of the parent company was $27,631,538, against $31,388,135.

The balance sheet at September 30 last showed current assets of $48,204,720, including $4,940,714 cash, $2,431,716 time deposits in banks and $32,797,164 loans to subsidiaries among other items: this compared with current assets of $43,918,625 on the same date in 1930, including $494,857 cash and $33,362,778 loans to subsidiaries. Current liabilities were $38,731,835, against $42,994,146.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

Operating Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Central Arizona Light & Power (Year ended October 31)					
Gross earnings	$3,199,477	$3,254,161	—2.0	55	56
Net earnings	1,416,627	1,420,776	—0.0	..	..
Detroit Edison (Year ended October 31)					
Gross earnings	49,637,023	53,949,042	—8.1	65	58
Net earnings	17,380,978	17,256,955	0.7	..	..
Florida Power & Light (Year ended October 31)					
Gross earnings	11,777,334	11,537,407	2.0	51	52
Net earnings	5,825,646	5,554,439	5.0	..	..
Kansas Gas & Electric (Year ended October 31)					
Gross earnings	5,711,300	6,025,555	—5.0	50	52
Net earnings	2,870,657	2,866,839	0.0	..	..
Louisville Gas & Electric (Year ended October 31)					
Gross earnings	10,860,385	10,545,168	3.0	..	..
Net earnings	5,998,521	5,368,125	11.7	..	..
Minnesota Power & Light (Year ended October 31)					
Gross earnings	6,205,933	6,486,797	—4.0	37	39
Net earnings	3,936,399	3,956,685	—1.0	..	..
Mountain States Power (Year ended October 31)					
Gross earnings	3,431,853	3,465,631	—0.9	..	..
Net earnings	1,195,869	1,249,782	—4.3	..	..
Nebraska Power (Year ended October 31)					
Gross earnings	6,838,558	6,509,506	5.0	47	49
Net earnings	3,606,533	3,311,941	9.0	..	..
Northern States Power (Year ended October 31)					
Gross earnings	33,968,559	33,181,690	2.4	..	..
Net earnings	17,429,054	16,758,228	4.0	..	..
Oklahoma Gas & Electric (Year ended October 31)					
Gross earnings	12,010,228	14,644,302	—18.1	..	..
Net earnings	5,734,543	6,961,227	—17.5	..	..

Operating Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
San Diego Consol. Gas & Elec. (Year ended October 31)					
Gross earnings	$7,417,164	$7,357,588	0.8	..	..
Net earnings	3,769,796	3,667,817	2.8	..	..
Southern Colorado Power (Year ended October 31)					
Gross earnings	2,137,461	2,297,463	—7.0	..	..
Net earnings	1,015,040	1,077,023	—5.8	..	..
Wisconsin Public Service (Year ended October 31)					
Gross earnings	5,564,876	5,634,377	—1.2	..	..
Net earnings	2,386,331	2,371,068	0.6	..	..
Wisconsin Valley Electric (Year ended October 31)					
Gross earnings	2,380,779	2,233,022	6.6	..	..
Net earnings	976,149	970,349	0.6	..	..

Holding Companies

Cities Service (Year ended November 30)					
Gross earnings	37,954,847	61,182,448	—38.0	..	..
Net earnings	35,654,315	58,781,453	—39.3	..	..
Federal Light & Traction (Year ended October 31)					
Gross earnings	8,129,211	8,536,907	—4.8	57	56
Net earnings	3,521,480	3,710,394	—5.1	..	..
Philadelphia Company (Year ended October 31)					
Gross earnings	57,625,937	62,209,099	—7.3	..	..
Net earnings	29,217,815	30,349,875	—3.7	..	..
Public Service Corp. & subs. (Year ended November 30)					
Gross earnings	137,801,294	138,507,734	—0.5	67	69
Net earnings	45,596,520	42,915,865	6.2	..	..
Standard Gas & Electric & subs. (Year ended October 31)					
Gross earnings	147,720,925	154,807,421	—4.6	..	..
Net earnings	72,779,839	74,337,484	—2.1	..	..

Business News and Markets

Standardization Promoted in Electrical Industry

BANCROFT GHERARDI, vice-president of the American Telephone & Telegraph Company, was re-elected president of the American Standards Association for the year 1932 at the annual meeting of the association held in New York on December 9.

Other officers, who were also re-elected, are: Cloyd M. Chapman, consulting engineer United Engineers & Constructors, Inc., New York, vice-president of the American Standards Association and chairman of the A.S.A. standards council, and John C. Parker, Brooklyn Edison Company, Brooklyn, N. Y., vice-chairman of the standards council.

Developments in national and international standardization work were reported at the meeting by both Mr. Gherardi and Mr. Chapman, who reviewed the progress of industrial standardization during 1931. Twenty-seven new national standards affecting almost every important industry in the United States have been completed by national committees of technical experts working under the association's auspices since January 1.

The advancement of standardization work in the electrical industry has been promoted during the past year, Mr. Gherardi said, by the organization of the electrical standards council to correlate the standardization activities of the entire industry under the auspices of the American Standards Association.

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British Duty on Electrical Goods

THE BRITISH BOARD OF TRADE has been quick to issue its list of articles on which customs duties will be levied under the abnormal importations (customs duties) act. The order became effective November 25, when a duty of 50 per cent of the value was imposed on all articles in the schedule. The schedule includes the following:

(a) Electrical vacuum cleaners and parts thereof.

(b) Radio sets and component parts thereof, including loud speakers and telephone receivers and parts thereof, but not including tubes, permanent magnets or batteries.

(c) Battery carbons. These are included in the annual statement of the board under the heading "Electrical carbons other than for lighting and furnace." The recorded imports under that heading amounted in October to 48,500,000 of a value of £21,000 ($105,000 at par) and consisted very largely of the small battery carbons upon which a duty is now to be imposed. The monthly average imported during 1930 amounted to 22,500,000. The increase is held at proof of a customs "abnormality" warranting the imposition of a duty.

▼

Southern Pine Pole Specifications

THREE DIRECT MAIL PIECES compiled for the information of engineering and purchasing officials concerned in the buying of poles are being distributed by the National Lumber & Creosoting Company of Texarkana. The first of these gives a graphic comparison of the existing specifications proposed by the American Standards Association. The second deals with the basis on which the new specifications were prepared, while the third contains copy of complete specifications for Southern yellow pine poles as prepared and approved by American Standards Association.

▼

Radio Tax Would Fall on Farmer and Laborer

THE PROPOSED TAX on radio sets would fall chiefly on the laboring man and the farmer, according to former Radio Commissioner Orestes Caldwell. Speaking before the Washington section of the Institute of Radio Engineers last week, Mr. Caldwell treated recent trends in the radio industry.

Discussing the proposed tax on radio sets the speaker said:

"If 3,000,000 radios are sold in 1932 at an average price of $70, a total net tax of only $10,000,000 will be collectible. Since the major part of recent sales of radio has been made to the working classes, where radio becomes the poor man's only entertainment, and since the farm population is still largely without radio sets, it follows that any future tax burden imposed on radio set purchasers will be borne chiefly by the laboring man and farmer."

Commonwealth Edison Purchases Switchgear

THE COMMONWEALTH EDISON COMPANY has ordered $375,000 in switching equipment from the Westinghouse Electric & Manufacturing Company for use in the latter's new Humboldt Park station in Chicago.

Chicago's 60-cycle electric current is supplied from a 66,000-volt tie-line which runs through the city from the northern boundary to the southeastern boundary and connects with lines of neighboring power companies. Four generating stations within the city feed electric current into this tie-line, from which the current is distributed by these same four stations and two additional switching stations. Humboldt Park is the newest of these switching stations.

▼

Producers to Limit Output of Copper

COPPER PRODUCERS have arrived at an informal agreement to reduce output to 26½ per cent of estimated capacity beginning January 1. The agreement also modifies certain regulations of Copper Exporters, Inc., which is the export selling agency for companies representing about 90 per cent of the industry's output. It is made clear in the announcement of the new plan that there is no authority to enforce this reduction in output.

While the duration of the agreement is specified under varying conditions, it is provided that after 1932 any company may resume operations as it sees fit on 30 days' notice. Furthermore, curtailment of output shall cease if the price of copper exceeds 12 cents in the domestic market for fifteen days or "if the total stocks of copper above the ground shall not equal the aggregate deliveries in the preceding four months."

The immediate occasion for the curtailment plan seems to have been the prospect of a large new production in Rhodesia. This threat of further new supplies seemed likely to drive prices still lower.

	Dec. 16, 1931 Cents Per Pound	Dec. 23, 1931 Cents Per Pound
Copper, electrolytic	6.50	7.25
Lead, Am. S. & R. price	3.75	3.75
Antimony	6.25	6.25
Nickel, ingot	35	35
Zinc, spots	3.50	3.50
Tin, Straits	21.60	22
Aluminum, 99 per cent.	23.30	23.30

Laminated Phenolic Products Standards

THE LATEST EDITION (November, 1931, publication No. 31-13) of the laminated phenolic products standards has just been published by the Laminated Phenolic Products Section of the National Electrical Manufacturers' Association. The new publication supersedes that of August, 1929, and comprises the latest available information covering the subject.

The new edition contains a large number of changes in the rules on tolerance for plate, tubing and rods. A new section on moisture absorption, physical properties and electrical properties for paper and fabric base laminated phenolic plate material has been added.

The latest system of numbering has been adopted for the standards rules, and to facilitate comparison with the old rule numbers contained in the previous issue a table of equivalent rule number has been incorporated.

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TRADE BRIEFS

Timken Roller Bearing Company announces that the latest revised edition of the *Timken Engineering Journal* is now available.

•

W. H. Cline, 90 West Street, New York City, has been appointed a representative for the Harold E. Trent Company, manufacturer of electrically heated equipment and heating elements.

•

Jeffery-Dewitt Insulator Company, Kenova, W. Va., has moved its office formerly at Albuquerque, N. M., to 7 Corona Street, Denver, Colo.

•

R. R. Ehle, president of International Resistance Company, Philadlephia, has announced the reduction of prices on I. R. C. metallized resistors.

•

I. M. Day has been appointed representative for the Northern Equipment Company with offices in Washington, D. C., and G. L. Simonds as representative in the state of Florida.

•

The Truscon Steel Company has taken over the Berger Manufacturing Company Building Products Division at Canton, Ohio, and will continue to operate it as Berger Building Products Division of the Truscon Steel Company.

•

The Wickes Boiler Company announces the installation of a most modern X-ray machine and complete laboratory facilities, which provides the Wickes shops with the necessary equipment to fabricate welded pressure vessels and power boiler drums strictly in accordance with the A.S.M.E. fusion welding codes.

•

J. G. Corrin has been appointed district sales representative of the Pennsylvania Transformer Company for the state of California.

•

W. M. Culbertson has been appointed to the sales organization of International-Stacey Corporation, Columbus, Ohio, in charge of tubular products sales.

•

Fuerst-Friedman Company, 1292 East 53d Street, Cleveland, Ohio, has changed its name to the Electric Generator & Motor Company. No other change was made. The company sells, rebuilds, repairs and rents electrical machinery and equipment.

•

The James R. Kearney Corporation, St. Louis, has taken over the Morse-Sterrett Products Company of Oakland, Cal., and the National Duct Rod Company, Portland, Ore. It also acquired the Chance Company of Centralia, Mo.

•

National Carbon Company, Inc., announces the appointment of J. M. Spangler as manager of its Eveready raytheon tube division.

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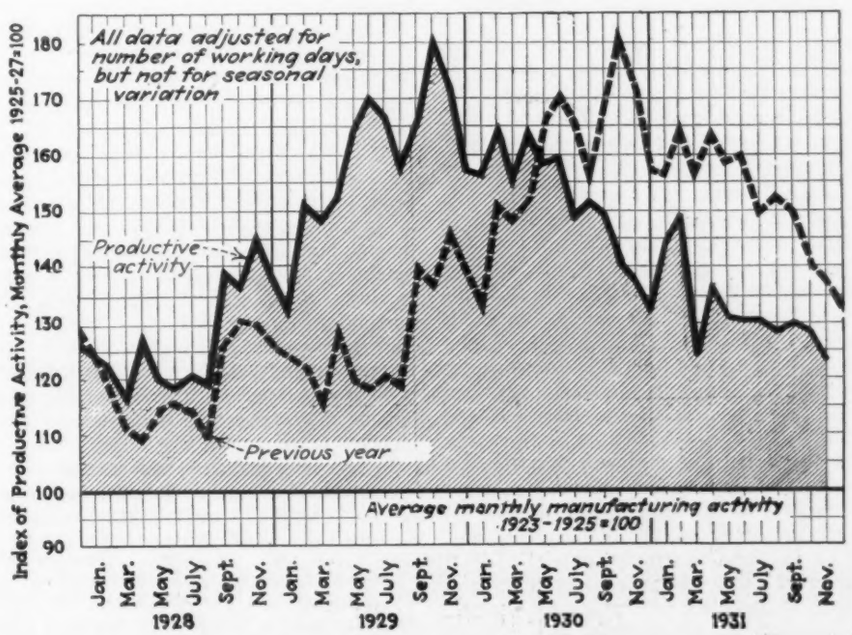
Electrical Manufacturing 10 per Cent Under 1930

ELECTRICAL manufacturing activity fell off 4 per cent in November, compared with October, measured by electrical energy consumption in factories of that group as reported to the ELECTRICAL WORLD, when adjustment is made for the difference in number of working days. The decline was slightly greater than that for the same two months in 1930 and much smaller than in 1929. It indicates that the industry is working at about the rate of late summer in 1928, and 10 per cent slower than at this time in 1930. The accompanying table provides data for other comparisons.

From examination of the individual returns it appears that in recent months the larger establishments have been accelerating their pace somewhat, while the smaller plants, many of them engaged in the production of appliances, have been less active than in the early autumn.

Comparative Index Numbers

	1931	1930	1929
November	123.3	137.5	169.5
October	128.5	140.6	180.6
September	129.8	150.0	168.8
August	128.0	152.2	155.4
July	130.1	148.5	166.6
Average 11 months	132.5	153.3	160.1



Barometer of productive activity in the electrical manufacturing plants of the United States

Market Conditions

APPROACH of the new year has developed greater activity in the electrical equipment field. Several substantial commitments are reported, especially in the Eastern district. Increased activitity is reported also from New England. The Southeast remains quiet.

——SENTIMENT IS SOME BETTER IN THE MIDDLE WEST, but orders continue slow in materializing. Staples are moving satisfactorily on the Pacific Coast, but volume of new business is decidedly limited.

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PACIFIC COAST

—THE END OF THE YEAR *finds a reasonably fair ordering of wiring and line staples, indicative of an actual consumer demand, but retail hopes based upon early December buying were not fulfilled and predictions are that 1931 holiday business will be about 10 per cent poorer than last year.*

—RETAIL DEMAND *is concentrating on food and drink mixers, clocks and the more useful and less showy hollow-ware items, with percolators, for example, in poor demand. Industrial and railroad business is practically non-existent and prospects for betterment, especially for railroads, are absolutely dependent upon improvement in general conditions; usual annual budgets are being held up with this proviso.*

Power company business affords the brightest immediate future, one manufacturer reporting a marked increase in staple meter and distribution transformer sizes, including a two-carload, estimated-value-$20,000, shipment to the Lodi area in central California. This past week the cityt of San Francisco provided outstanding orders for the week, comprising a lot of pumping motors for the Coast Range tunnel, including nine 1,000-hp. and three 900-hp., valued at about $45,000. These were bought from an electric machinery company. The same job also required six 1,667-kva. Moloney transformers, valued at $23,000. Other large jobs are marking time and will probably do so into February or March. Power lines paralleling water projects will afford the bulk of much business, and even if they run only one-half of 1 per cent of the total amount that was appropriated they will reach the sum of $2,000,000, of which half has already been voted.

Electric heater business is very brisk, one San Francisco manufacturer reporting close to 8,000 of various sizes shipped in the first three weeks of December, of which 1,200 ran 3 kw. or over. Last-minute orders reported by Westinghouse include $6,000 worth of street-lighting equipment for San Jose, a lot of induction motors and controls for a Honolulu plantation valued at $3,500, and $8,000 worth of miscellaneous substation equipment valued at $7,500 for the University of California's new power plant at Berkeley.

The volume of electrical sales of motors, apparatus, wire and cable last week was said to be the lightest during the year, attributable to business conditions generally and the approaching holiday season. There was, it was stated, a fair movement in radio, refrigeration and electrical giftware, with indications that this movement may be further augmented until the Christmas holiday.

Lumber production in the Northwest was unchanged, with mills reported as operating at 26 per cent capacity, as compared to 44 per cent one year ago. Sales reported included about $750 worth of miscellaneous switchgear to central stations; 25 motors from 40 hp. down to scattered miscellaneous sources; 30 machines, mainly 25 hp. and under, to small industrials and dealers; eight machines from 20 hp. down to a woodworking plant and twelve motors, 10 hp. and under, to dealers. The Washington Gas & Electric Company of Everett plans expenditure of $10,000 in new construction, including main extension and transmission lines in the Everett district, during 1932.

CONSTRUCTION PROJECTS

Los Angeles Harbor Department, Los Angeles, Calif., is completing plans for a transit building at the harbor, estimated to cost $125,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until January 6 for air compressors for naval operating base at San Diego, Calif. (Specification 6650). California Institute of Technology, Pasadena, Calif., soon takes bids on revised plans for multi-story chemistry and biological buildings to cost $600,000. Redlands Irrigation District, Grand Junction, Colo., approved plans for hydro-electric generating plant to cost $100,000. Deer Lodge, Mont., plans installation of electric-operated pumping machinery in connection with a water works project to cost $200,000.

EASTERN

—WHILE ELECTRICAL EQUIPMENT *purchases throughout the past month have been quite lean in the Eastern district, the approach of the new year has developed improved activity and a number of sizable commitments can be recorded. With a little prophecy toward the immediate future, the first quarter of 1932 is not expected to show any startling revival in electrical account.*

—CENTRAL-STATION APPROPRIATIONS *are being watched for eagerly, and likewise prospective purchases for railway electrification. Industrial account seems to hold better promise than at any time during the past half-year, and buying of motors, controls and accessory apparatus is expected to trend upward. Government business presents a favorable outlook, save for the rather reckless price cutting in an effort to secure federal orders.*

A New York manufacturer has been awarded a contract for switchgear and auxiliary equipment for central-station service, totaling $175,000. A metropolitan power company has placed an order for a quantity of cable with a New York maker, approximating $390,000. Kelman Electric & Manufacturing Company is low bidder at $14,350 for two 110,000-volt oil circuit breakers for the city of Los Angeles.

Port of New York Authority is placing various contracts in connection with its large terminal project on the west side, on which work has begun. The award for freight elevators has been given to the Otis Elevator Company. Contract for switchgear and accessory equipment, totaling $55,000, was secured by a New York manufacturer. Otis Elevator Company also has obtained a number of other sizable awards in the past week or so, including units in the New York Life Building, Kansas City, Mo. The Westinghouse Electric Elevator Company will furnish elevators in the different buildings of the $40,000,000 "radio city" project of the Rockefeller interests at New York, the order aggregating $2,000,000. A commitment for switchgear for the new Bankers' Trust Building, New York.

has been secured by a New York maker at a price of $30,000.

CONSTRUCTION PROJECTS

Todd, Robertson & Todd Engineering Corporation, New York, engineer for new "radio city," in Manhattan Borough, has plans for steam-electric power plant for emergency service, reported to cost over $300,000 (contract for central station service awarded to United Electric Light & Power Company under normal operations). Department of Sanitation, New York, secured appropriation of $4,400,000 for four garbage and refuse incinerator plants, with electric-operated equipment, substations, etc. American Smelting & Refining Company, New York, plans expansion and improvement program at gold mining properties at Kernville, Calif., including machinery, to cost close to $1,000,000. Department of City Transit, Philadelphia, Pa., will receive bids until December 29, for electrical equipment for substations and city subway. Public Improvement Commission, Baltimore, Md., is having plans drawn for high school at Patterson Park, with manual training department, to cost about $750,000.

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SOUTHWEST

—CHRISTMAS BUSINESS *has not been up to expectations and it is doubtful whether the few days remaining will pull the volume up to the five-year average for the holiday season. On the whole, the demand has been disappointing, even allowing for general conditions.*

—FEW REAL ORDERS *are being signed these days as every one is waiting for the new year before acting. However, a contract for a 1,000-kw. turbo-generator and condenser, switchboard, etc., has been signed by a public institution in a southwestern state, the amount involved being about $40,000.*

An Iowa community has awarded the contract for one 210-hp. Diesel engine and is changing its plant and distribution system from direct to alternating current at a cost of about $41,000. Utilities and industrial buyers continue to purchase only for immediate need, but it is believed that as general conditions improve light and power plants will be compelled to expand considerably to take care of load demand.

CONSTRUCTION PROJECTS

Marquette Cement Manufacturing Company, Chicago, Ill., will make improvements in mills at Cape Girardeau, Mo., and La Salle, Ill., to cost $500,000. Lakeside Light & Power Company, St. Louis, Mo., operated by Union Electric Light & Power Company, contemplates transmission lines in Lake of Ozarks district, to cost over $100,000. University of Texas, Austin, Tex., will receive bids until January 29 for engineering building and group of other structures, to cost close to $4,000,000, with equipment.

❖

NEW ENGLAND

—ELECTRICAL EQUIPMENT SALES *in this district during the past week have been moderate in volume and arc-welding equipment is being studied for special applications by a number of specialty manufacturers. Extension of electric traffic control has been ordered for an important Boston thoroughfare and orders for 500-watt lamps for service stations of a prominent oil distributing company have been recently placed.*

While spotty conditions prevail in industrial activity in this district, northern New England shows encouraging stability, as noted in a recent report showing 11.4 per cent greater power output for a prominent utility as compared with last year. The New England Telephone & Telegraph Company plans to spend approximately $2,300,000 for service improvements.

CONSTRUCTION PROJECTS

Saco-Lowell Shops, Saco, Me., plans expansion program at local textile machinery plant, with removal of branch plant from Newton Upper Falls, Mass., to Saco., estimated to cost about $450,000. Board of Education, Springfield, Mass., contemplates call for bids early next year for a technical high school to cost $350,000. Boston Traffic Department, Boston, Mass., contemplates extensions in traffic signal system to cost about $40,000. Board of Education, Westbrook, Conn., is asking bids until December 29 for high school to cost $130,000 and plans manual training department.

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MIDDLE WEST

—GENERAL BUSINESS *in this section continues to drift along an uneven course. The volume of business is falling off toward the close of the year and very little, if any, tangible evidence of improvement is in sight.*

—A SOMEWHAT IMPROVED *feeling is observed and the coming of the new year is awaited with hopeful expectancy. Steel operations are sagging and as yet orders from the automotive trade have not materialized.*

Some small inquiries are being received from the railroads, but the general railroad situation has not improved. Carloadings have declined and will probably continue to decline until the end of the year. Wholesale and retail activity is as good as can be expected and concerted advertising does not seem to improve the situation much. The various utility companies are marking time, with very little construction work going on.

Among the interesting orders to be placed this week were the following items: 100 10-kva., 25 15-kva., 25 37½-kva. single-phase, pole-type distribution transformers and "Mazda" lamps valued at $150,000.

CONSTRUCTION PROJECTS

Two Rivers, Wis., will receive bids until December 29 for an electric generator for city power plant; until January 12 for a switchboard and auxiliary equipment. Lake Geneva, Wis., plans extensions in transmission and distributing lines, and will soon vote bonds. Park Department, Indianapolis, Ind., contemplates purchase of electric-operated pumping machinery for use at Riverside Park. Department of Public Service, Columbus, Ohio, will install electric-operated pumping machinery in connection with sewage disposal plant and system to cost $3,500,000. United States Engineer Office, Duluth, Minn., will receive bids until January 4 for a direct-connected steam turbo-generator set (Circular 30). Sioux City Gas & Electric Company, Sioux City, Iowa, authorized addition to Big Sioux power plant, to cost over $85,000.

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SOUTHEAST

—THE TONE OF BUSINESS *in the Southeast continues very dull. Such orders as are received are small and for run-of-mine materials. There are a few propositions pending, but there seems to be no definite indication as to just when orders will be placed.*

There are a number of mill electrifications being considered, and if these materialize they will result in some satisfactory large equipment orders during the first part of 1932. A textile mill in the Carolinas last week placed an order for $3,500 worth of tex-rope drive, while an Alabama power company ordered relay equipment costing approximately $1,500. A Georgia company ordered transformers amounting to $1,500. Inclement weather has served to retard Christmas trade.

CONSTRUCTION PROJECTS

Charlottesville Woolen Mills, Charlottesville, Va., approved construction of addition to cost close to $100,000. Treasury Department, Washington, D. C., asks bids until January 5 for post office building at Montgomery, Ala., to cost $850,000. Starkville, Miss., has plans for a power plant to cost $100,000, with equipment.

New Equipment Available

Direct-Reading Light-Intensity Meter

AN INSTRUMENT WHICH READS illumination intensities with the same ease and facility as reading ammeters and voltmeters has been developed by the Weston Electrical Instrument Corporation, Newark, N. J., and is known as model 603 "Illuminometer." It consists of an indicating instrument and a light target assembled in a portable case. The light target may be placed in any position. It has two photronic

cell units which convert light energy directly into electrical energy without the use of batteries or other auxiliary voltage. They maintain constant output over long periods of time and there is no "dark current." The output from the photronic cell units is considerable, allowing the use of a rugged portable instrument calibrated directly in foot-candles.

A range-changing switch is provided for the selection of the three ranges on the instrument, namely, 10, 50 and 250 foot-candles. Readings may be taken quickly and accurately and the time required to make a lighting survey is about one-tenth of that previously required.

▼

Shoe-Type "Thrustor" Brakes for A. C. Motors

A LINE OF SHOE-TYPE, weatherproof, Thrustor-operated brakes, type CR9516, for alternating-current motors on mill, crane, hoist and similar applications where severe service requirements must be met, has been announced by the General Electric Company. These brakes provide quick, cushion-like braking in either direction of rotation with either light or heavy loads and are adjustable for braking torque over a wide range.

In a fraction of the "Thrustor" stroke the motor comes up to full speed and the speed of thrust remains constant during the remainder of the stroke. The uniform speed characteristic also results in a smooth, cushion-like setting when the brake is de-energized. Use of the "Thrustor" minimizes braking mechanism inertia, shock and noise. With a "Thrustor" brake the motor armature may be rotated when jogged as little as 1/20th of a revolution.

Some of the features of the brake are adjustable torque, positive braking in either direction, self-aligning brake shoes, carefully balanced wheels, motor-mounted brakes requiring no base for mounting, and cannot get out of alignment.

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Inclosed, Self-Contained Motor-Starter Unit

A MOTOR STARTER, designated type ZO, which is a self-contained unit and is totally inclosed in a heavy pressed-steel case with oil-immersed main and control circuit contacts and vapor-proof overload relays, has been placed on the market by the Electric Controller & Manufacturing Company, Cleveland, Ohio. The entire unit is of very compact design, requiring little mounting space, and is of dust-tight construction.

Two thermal-type overload relays are used to protect the motors against single-phase and overload conditions. The starter may be used for low-voltage release or low-voltage protection applications. Standard, vapor-proof, or explosion-proof push buttons are available for use with these starters.

▼

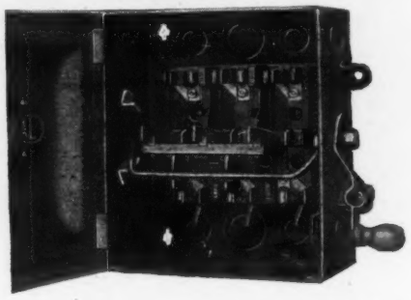
Ball-Bearing Motor with Built-In Speed Reducer

A LINE OF FRACTIONAL-HORSEPOWER MOTORS with worm-gear speed reducers has been announced by the Bodine Electric Company, Chicago. These motors are built in the new Bodine type N-5 frame. Gear reductions of 10-1, 20-1 and 40-1 are available, which afford slow shaft speeds of 28, 43, 56, 86, 112 and 172 r.p.m. at standard motor speeds of 1,125 and 1,725 r.p.m. The speed reducer consists of a separate nitralloy steel worm and an oversize bakelite gear, mounted in a grease-tight housing forming an integral part of the end shield of the motor. The motors are rated from 1/20 to ⅛ hp. and are available in two types—type NSIR for alternating current and type NSHR for direct current.

Safety Switches Provided with Fuse Ejector

A LINE OF quick-make-and-break safety switches designated type C, from 30 to 600 amp., has been announced by the Federal Steel Products Company, Newark, N. J. The switch is provided with a simple quick-make-and-break mechanism and is so constructed that if the spring mechanism should get out of order it is possible to throw this switch to the complete "off" position, but not to the complete "on" position. Rubber bumpers are provided inside the switch to reduce noise when the switch is operated.

All 30- and 60-amp. switches are being provided with the fuse ejector



to facilitate the removal of cartridge fuses. In operation a simple pressure on a lever is all that is necessary to extract the fuse from the fuse clip, which ordinarily requires several pounds of pressure to remove in the regular manner.

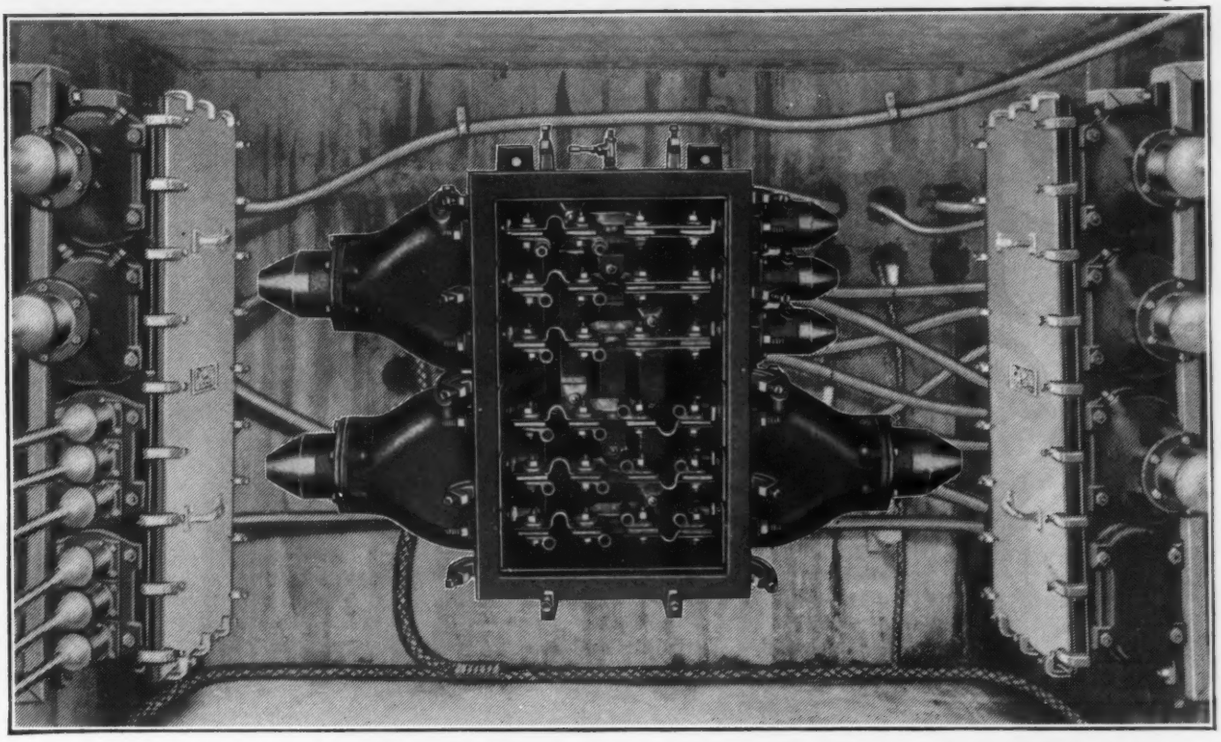
▼

A LIGHT-WEIGHT ELECTRIC HAMMER made possible by operating the hammer through a special flexible shaft attachment connected with any light type ½-in. electric drill has been announced by the United States Electrical Tool Company, Cincinnati. In addition to the large decrease in weight for a hammer of this capacity, it is claimed that the flexible shaft also prolongs the life of the tool by absorbing the destructive jarring otherwise imposed on the power unit. Specifications claim 4,000 blows per minute up to one inch, the finest Swedish steel in the hammer member and high-grade ball and roller bearings throughout.

•

A SKINNING KNIFE FOR LINEMEN, produced to meet the demand for a high-quality knife providing the additional safety of an insulated handle, is announced by Mathias Klein & Sons, Chicago. The hole in the handle, provided for a ring or thong, is through the solid rubber, and in this way obviates the danger of a flashover when the knife is used between close taps or other confined space.

G&W UNDERGROUND BOXES . . .



. . . EXACTLY suited to YOUR job

THE boxes installed are G&W type "A", eight way, three conductor, for 600 volt service. They were made exactly for the job, and there was no price penalty. Note the interchangeability of cable heads to accommodate single or multiple conductor cables. And the flexibility of the inner structure. Changes in the system will not obsolete these boxes! The same contact fittings are used for either solid links or copper fuses. G&W boxes have light weight covers for easy handling, held down with "C" clamps which cannot be lost. Hardware is corrosion resisting throughout. Machined, flanged surfaces effectively gasketed make every G&W box air-tight. Bus structure is of cold drawn copper, and is well taped. Every detail is correct.

We can make this box problem easy for you — as we do for the man working with G&W equipment in a cramped manhole. Send us the installation data and let G&W work out the details for you and recommend a box that will be exactly suited to your particular job.

A GOOD LAYOUT DESERVES G&W BOXES

Potheads • Subway Boxes • Cable Terminal Devices • Automatic Transfer Switches

G&W Electric Specialty Co.

7780 Dante Avenue, Chicago • • • • Representatives in Principal Cities

AIR-COOLED AMERTRAN TRANSFORMERS

AmerTran Type "R" Transformers are made in sizes of 25 and 50 va. and for use in 25- or 50/60-cycle circuits. Available with primary wound for 110, 220, 440 or 550 volts; secondary 110 volts (standard) or other voltages on special order. Units for 50/60-cycle operation are carried in stock.

A NEW ITEM for Switchboard Manufacturers

"Not A Bell Ringer"

Large Overload Capacity

Moistureproof, Rugged

Easily Installed

Available From Stock

AmerTran Type "R" (relay) Transformers are small and efficient, have good regulation, and are designed for continuous operation at full load. They are ideal for operating relays, tripping devices, "stop-motion" apparatus, solenoids, and signalling systems. Units for standard voltages are available from stock; special sizes can be shipped in one week.

AMERICAN TRANSFORMER COMPANY

170 Emmet St., Newark, N. J.

Branch Offices: Boston Chicago Cleveland Detroit Knoxville Montreal New York Philadelphia San Francisco St. Louis

AMERTRAN TRANSFORMERS

THE RATCHET SLEEVE TWISTER

THE illustration shows the use of Kearney Ratchet Sleeve Twister with a standard twister. Dies are made for sizes of wire ranging from No. 6 solid copper to 250,000 C. M. copper and are interchangeable in both twisters. Handles are made of either steel, wood, or bakelite.

The large size standard twister is made for wires of 500,000 C. M. copper and smaller.

OTHER KEARNEY PRODUCTS

Solderless Connectors; Double Duty Cutouts; Rural Fuse Switches; Standard Fuse Switches; Disconnect Switches; Fuse Pullers; Plug Cutouts; Guy Clips; Live Line Clamps; Rural Line Clamps; Cable Clamps; Cable Ring Saddles; Grounding Sets; Live Line Tools and Accessories; Underground Boxes; Pole Top Gang Switches; Quick-Break Gang Switches; Lox Round Guy Guards; Fuse Link Boxes; Hitemeters; Kearney Chance Anchors.

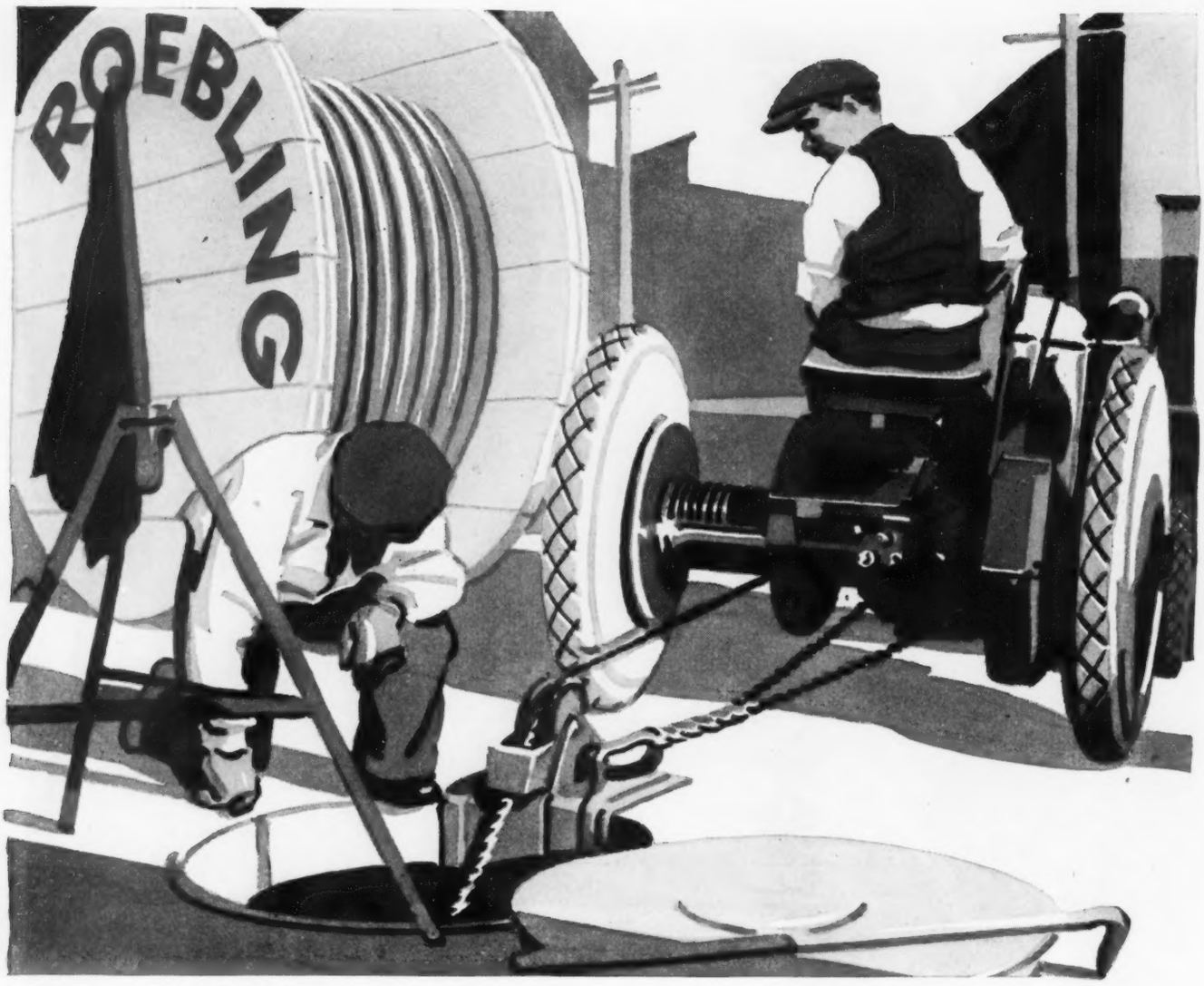
JAMES R. KEARNEY CORPORATION

4224-42 CLAYTON AVE. • ST. LOUIS, MO.

Factories: St. Louis, Mo. • Taylorville, Ill. • Centralia, Mo. • Toronto, Canada

KEARNEY

IMPROVED SLEEVE TWISTERS



ROEBLING

POWER CABLES for underground transmission or distribution —impregnated paper, varnished cambric or rubber insulated —can be obtained from Roebling. In fact, no matter what your wire and cable needs may be, they can be satisfied by the Roebling Line. ¶ There are over 60 types of Roebling Wires and Cables—ranging from the finest magnet wire to heavy armored submarine cable. ¶ When you need wire or cable in a hurry—sample the on-the-dot Roebling Service provided at all offices listed below. A wide variety of standard types of Roebling Wires and Cables are stocked at these points and can be shipped at once.

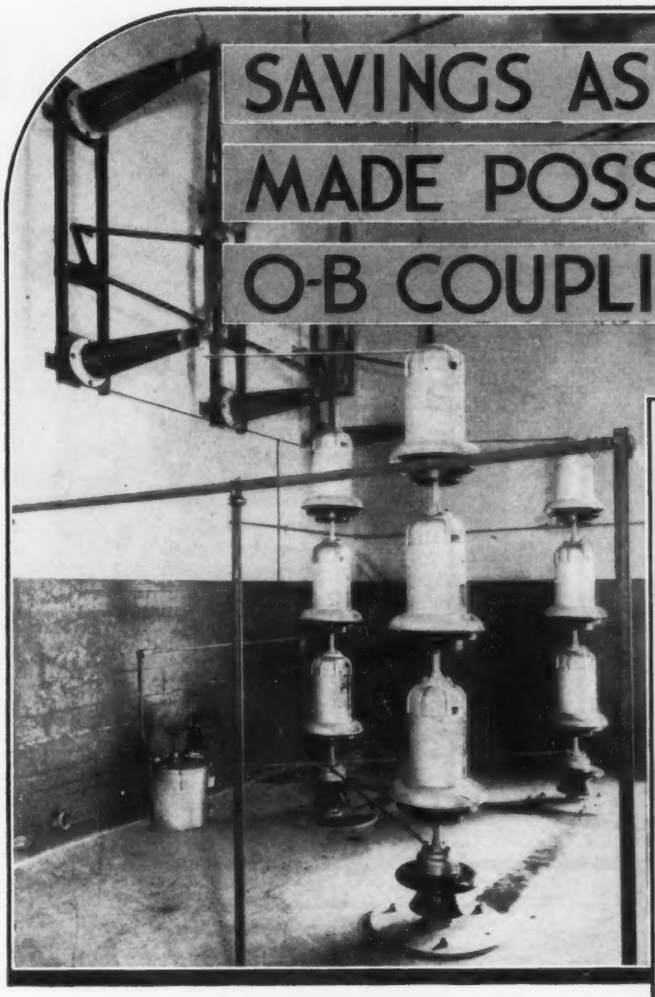
Power Cables · Paper; Cambric; Rubber » Submarine Cables » Tree Wire » Parkway Cable » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables · Braided and Leaded · Code: Intermediate; 30% » Slow-burning Wires and Cables » Weatherproof Wires and Cables » Portable Cords » And a wide variety of other wires and cables.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

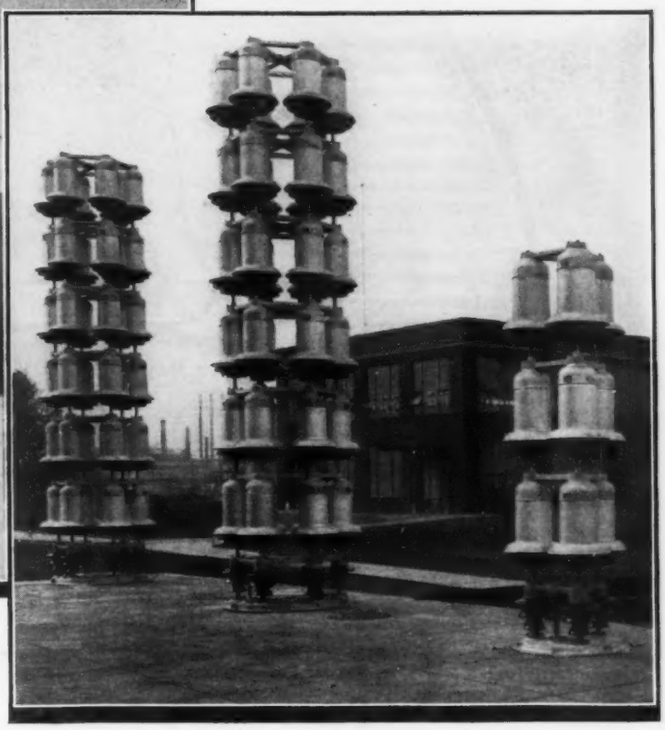
Atlanta Boston Chicago Cleveland Los Angeles New York Philadelphia Portland, Ore. San Francisco Seattle Export Dept., New York, N.Y.

ELECTRICAL WIRES AND CABLES

SAVINGS AS GREAT AS 45.4% MADE POSSIBLE WITH O-B COUPLING CONDENSERS



O-B Coupling Condensers provide low-voltage energy for system relay-operation at this substation.



Ohio Brass Coupling Condensers
They stack up like switch or bus insulators. Are easy to handle and conserve space.

THERE are cases where the use of Ohio Brass Coupling Condensers has netted savings as great as 45.4%. Originally introduced for use with carrier telephone equipment, their application has been extended successfully to that of securing low voltage energy for the operation of synchronoscopes, system relays, or for voltage indication.

Not only is a substantial saving usually shown in a cost comparison between condensers and other equipment for securing low-voltage energy, but the saving is extended to installation and maintenance costs as well. These condensers are very compact, and conserve space. In out-of-doors installations, smaller foundations are needed. Little oil is required in the small transformer. Routine inspection or attention is all that is necessary for continuous reliable operation.

Engineers considering the advantages of instrument use in high-voltage operation, may find it profitable from the cost standpoint to thoughtfully consider how Ohio Brass Coupling Condensers might be used in their plans. In this connection, O-B District Representatives will gladly cooperate by giving cost and engineering information about O-B condensers as they apply to specific needs and cases. Or additional information may be had by addressing:

1467H

OHIO BRASS COMPANY

Mansfield, Ohio, U.S.A.

Canadian Ohio Brass Co. Limited — Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland · St. Louis · Atlanta · Dallas · Los Angeles · San Francisco · Seattle

". . and now more than ever

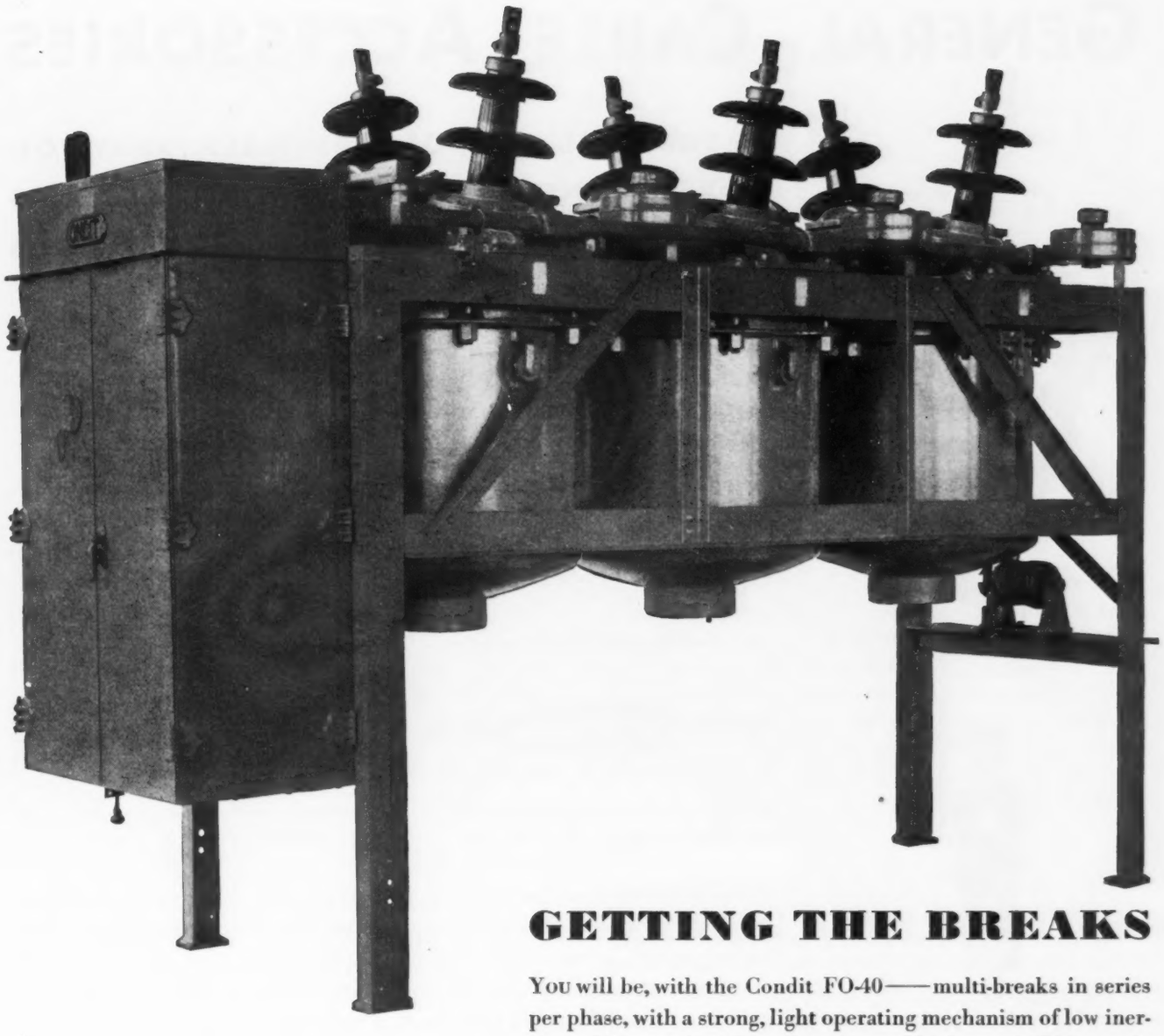
. . . . . the research work that has been instrumental in advancing the art of insulator design and manufacture to its present high plane continues unabated.

The Locke high voltage and ceramic laboratories are still checking and rechecking, testing and retesting in a progressive endeavor to add still further improvements and refinements to the insulator you buy.

Quality today has, if possible, assumed an even greater importance than ever before. And, in Locke Insulators, it is being jealously maintained. Locke Insulators have been, are, and always will be the finest that can be produced by a combination of selected materials, accurate design, precise manufacturing methods and exact plant control."

LOCKE PORCELAIN INSULATORS

LOCKE INSULATOR CORPORATION . . . . BALTIMORE, MARYLAND



GETTING THE BREAKS

YOU will be, with the Condit FO-40——multi-breaks in series per phase, with a strong, light operating mechanism of low inertia, and hence of swift acceleration and high speed. This sturdy oil circuit breaker has steel tops and tanks of extraordinary strength: also provision for venting, and for the effective restraint of oil throwing. The operating mechanism, either solenoid or motor, is mechanically trip free at any position of stroke. Liberal bushings are provided, well balanced mechanically and electrically. In short, you can find no high voltage, high interrupting capacity outdoor breaker in which you get so much for the rating as in the FO-40. Write for full details.

FO-40

"Get in touch with Condit"

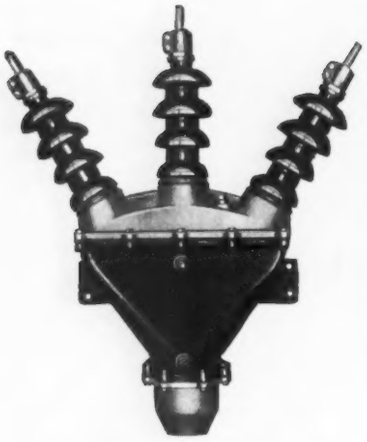
CONDIT ELECTRICAL MFG. CORPORATION

Boston, Massachusetts, U. S. A.

CONDIT

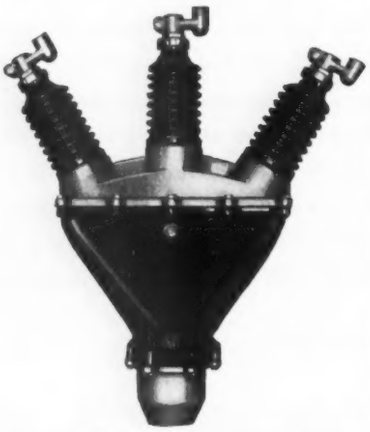
GENERAL CABLE ACCESSORIES

A COMPLETE LINE OF TERMINALS, JUNCTION BOXES, JOINTING AND INSULATING MATERIALS TO FILL ALL PRACTICAL OPERATING REQUIREMENTS



Outdoor terminal with removable insulators for multi-conductor 15 kv. cable.

Low voltage oil-tight end seal with soldered porcelain.

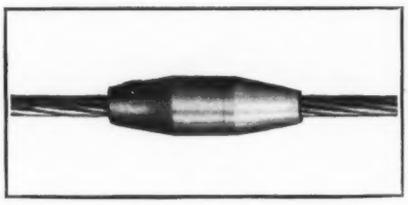


Indoor oil-tight terminal with special bracket for multi-conductor 15 kv. cable.

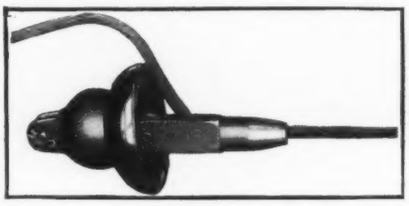
General Cable terminals will meet the most severe conditions of your system and will assure freedom from service interruption.

Available in any desired shape or type of cable entrance; compound-tight with removable insulators or oil-tight with bolted and gasketed or soldered porcelain joints; for operation at all voltages. There is a General Cable terminal to meet the most varied specifications.

• • •



Peerless connector in straight line application.



Peerless connector in "dead-end" application.

Peerless Aerial Line connectors and dead-ends will greatly facilitate connecting and dead-ending your overhead distribution lines. Providing quick, economical and strictly mechanical connections with all the electrical and mechanical characteristics required, they are also non-corrosive and free from weather-cracking.

• • •

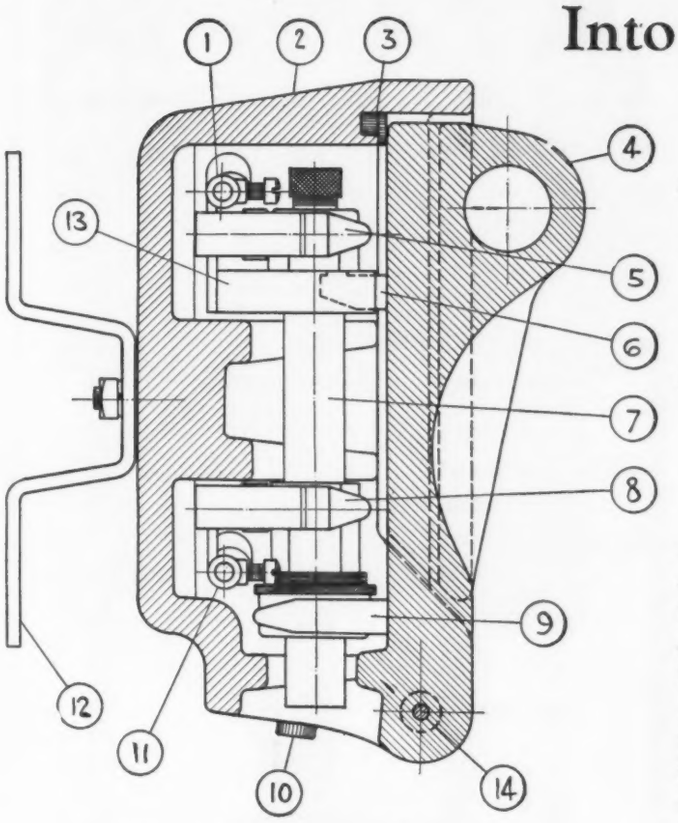
Jointing material for all types of cables including connectors, saturated paper tape, saturated paper tubes, standard or "low-loss" varnished cambric tape, excelsite rubber tape, pure cut sheet rubber, lead sleeves with Triple Seal filling plugs, reservoirs, stop joints, insulating lead sleeves, Ozite "B" and other filling compounds of highest quality are available from stock. Recommended joint designs are gladly supplied. Refer your accessories problems to our nearest district office who will gladly cooperate with you.

GENERAL CABLE CORPORATION

EXECUTIVE OFFICES: 420 LEXINGTON AVENUE, NEW YORK • CONSULT OUR NEAREST OFFICE

Let Us Look Further

Into The Make-up Of This All Porcelain TRANSFORMER CUTOUT



Check These Features:

1, 11—Upper and Lower Line Connectors
2—High Tension Wet Process Porcelain Housing
3, 10—Resilient Door Stops
4—High Tension Wet Process Porcelain Door
5, 8—Upper and Lower Full Floating, Self Aligning Contact Clips
6, 9—Upper and Lower Fuse Cartridge Holders
7—Fibre, Bakelite Covered Fuse Cartridge
12—U-Bolt Type Mounting Bracket
13—Positive Door Latch
14—Friction Type Hinge

Our Products Include:

High Tension Wet Process Porcelain Insulators for Transmission and Distribution Lines.

Special Insulators and Bushings of High Tension or Low Tension Porcelain.

Secondary Racks, Insulated Clevises, House Brackets and Service Knobs.

The Housing and Door—

The Housing and Door of the Cutout are manufactured of High Tension Wet Process Porcelain, from a combination of the highest quality Imported Clays and domestic materials obtainable. High Tension Wet Process Porcelain is homogeneous in structure, free from any internal stresses and laminations. It is, therefore, possible to produce Housings and Doors that are uniformly vitrified throughout their entire shape with high electrical and strong mechanical characteristics with no traces of porosity.

The insulating qualities of High Tension Wet Process Porcelain are beyond question. Insulators of this material will absorb no moisture and weather perfectly. Because of these facts our Cutouts are equipped with a High Tension Wet Process Porcelain Door of the same materials as the Housing.

While the door is normally under no voltage stress it is subjected to the line voltage after the fuse has blown and must be a perfect insulator if creepage currents from contacts to ring handle and between contacts are to be cut to a minimum. The use of a Cutout then with a High Tension Wet Process Porcelain Door means absolute and permanent protection to expensive Power Equipment and above all perfect safety to the operator when fuses are replaced. Then, too, the Wet Process Porcelain Door will not warp or become wedged in the housing. It can be operated under the most adverse weather conditions with ease and safety.

Other special feaures of this Cutout will be discussed in future advertisements.

Sales Offices and Warehouses in Principal Cities

PP TRADE INC MARK

PORCELAIN PRODUCTS, INC.

PARKERSBURG, W. VA.

LARGEST PRODUCERS IN THE WORLD OF ELECTRICAL PORCELAIN

PP TRADE INC MARK

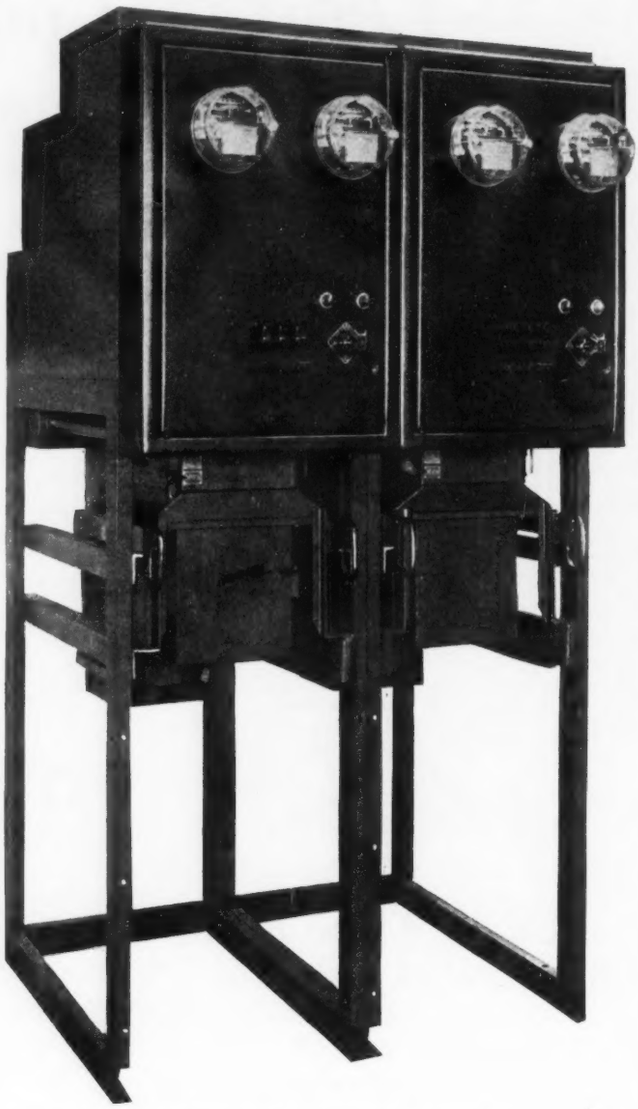
Metal-Clad Switchgear

The solenoid operated 7.5 K.V. oil circuit breakers are easily removed or replaced by a truck. An arrangement of interlocks prevents removal of breaker or insertion into the disconnects until breakers are in open position. Indicators on the front show whether breakers are in open or closed position.

Each circuit has its own current transformers. Potential transformers are optional, as are Single or Multiple Conductor Cable Terminators. When desired, the switchboard panels with control switches for controlling the breakers, calibrating terminals and indicating lamps, instruments and relays can be omitted.

Low installation costs—as units are factory wired and assembled, reducing field labor to the minimum. An opportunity to give you complete data will be appreciated.

This new Metal-Clad Switchgear is safe, dust and vermin-proof. The factor of insulation is high, and short circuits, due to entrance of rats or other animals, are prevented.



Single unit assembly

Modern Metal-Clad Switchgear will help speed up installation, reduce costs and give quicker service. Before specifying any particular make, investigate DELTA-STAR UNIT TYPE. It will pay you to see what we have to offer.

UNIT TYPE is equipped with the latest form of oil circuit breakers, built for either solenoid or motor operation. They are as "modern" as the latest type of generating equipment you plan to install.

DELTA-STAR engineers are continually working and co-operating with purchasers to give them exactly the right switchgear—to give the best possible service.

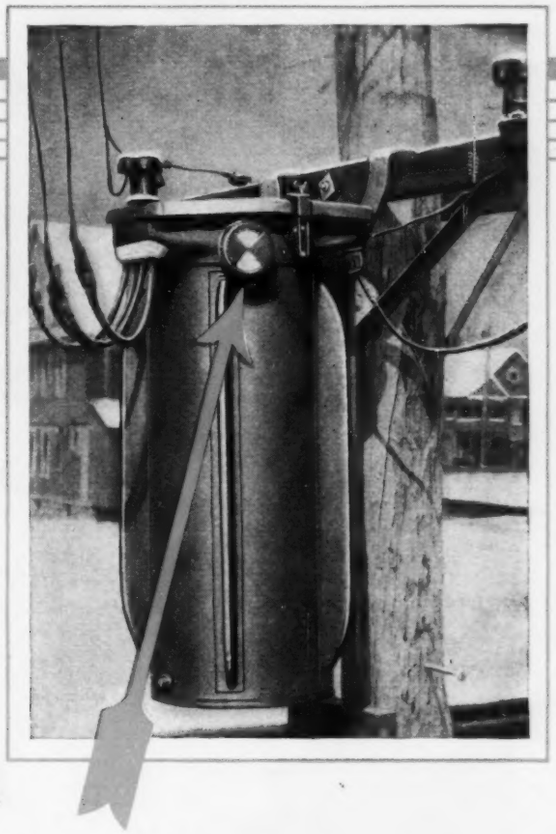
Why not learn more about this new development? We will gladly tell you.

DELTA-STAR ELECTRIC CO.

CHICAGO, ILLINOIS

2400 BLOCK, FULTON STREET

Right) Cat. No 8K1A1, pole type, with overload signal tripped. (Below) Cat. No. 8K2A1, for subway and large distribu tion transformers, showing partial load registration



Do you KNOW the margin of available capacity?

WHY not be certain of the efficiency of application of your distribution transformers? The Thermotel SHOWS AT A GLANCE* the relation between the load requirement and the available transformer capacity. Installed on each transformer, it will help you prepare for the winter peak and prevent interruptions to service.

You can apply the new Thermotel to G-E distribution transformers as small as 5 kv-a. and as large as 200 kv-a. Adjustment for transformers of different size is effected simply by shifting an external lever. Installation requires but a few minutes.

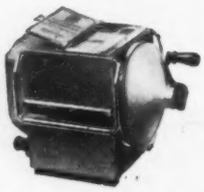
Thermotels are more fully described in Bulletin GEA-309. They are available for immediate shipment from our district warehouses.

*The Thermotel indicates directly the per cent of available transformer capacity actually being used. This is possible because the Thermotel automatically corrects for ambient temperature.

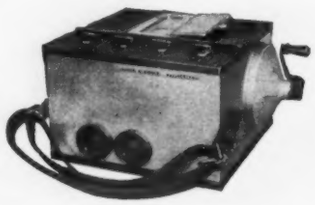
405-33

GENERAL ELECTRIC

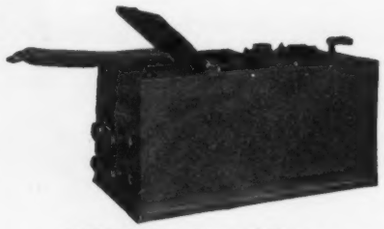
JOIN THE "G-E CIRCLE"—SUNDAYS AT 5:30 P. M. E. S. T. ON N. B. C. NETWORK OF 54 STATIONS—WEEK-DAYS (EXCEPT SATURDAY) AT NOON



"MEG" Insulation Tester
Ranges up to 100 megohms, 500 volts.



"BRIDGE-MEG" Resistance Tester
Range .01 ohm to 100 megohms.



"MEGGER" Ground Tester
for testing the resistance to earth of installed ground connections.

1000-Volt "SUPER-MEG" Insulation Tester
Range 0 to 200 megohms.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
INSTRUMENTS

All the way—

UP—to 10,000 Megohms
DOWN—to .000001 Ohm.

FOR those who need simple-to-use resistance-testing instruments within this wide range, "Megger" offers a solution. Various types and ratings have particular applications, viz —

— for "Megger" tests of insulation resistance from as low as 1000 ohms to as high as 10,000 megohms

— for "Megger" tests *and* Wheatstone Bridge tests from as low as .01 ohm to as high as 2000 megohms

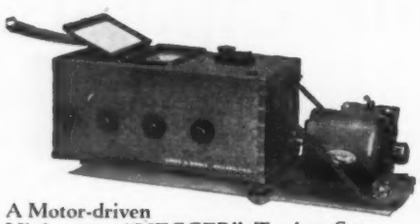
— for testing the resistance to earth of ground connections from as low as .1 ohm to as high as 3000 ohms

— for testing conductor and contact resistances from as low as .000001 ohm up to 5 ohms

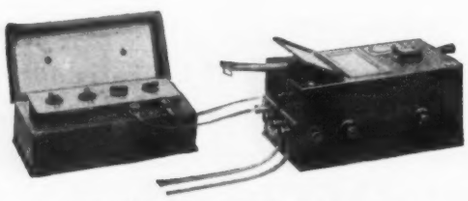
— for testing condenser leakage and water purity, reading in units of conductivity.

We invite inquiries from engineers who know "just what to use," as well as from those who have testing problems in the solution of which our experience might be helpful. Appropriate literature will be mailed on request.

Standard High-range "MEGGER" Testing Set
Ranges up to 10,000 megohms.



A Motor-driven High-range "MEGGER" Testing Set

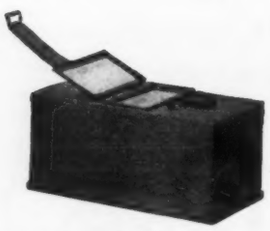


"BRIDGE-MEGGER" Testing Set
Ranges from .01 ohm up to 2000 megohms.

JAMES G. BIDDLE CO.
ELECTRICAL INSTRUMENTS
1211-13 ARCH STREET PHILADELPHIA, PA.

For *instrument accuracy and machine ruggedness*, "Megger" instruments have few if any parallels among electrical measuring devices.

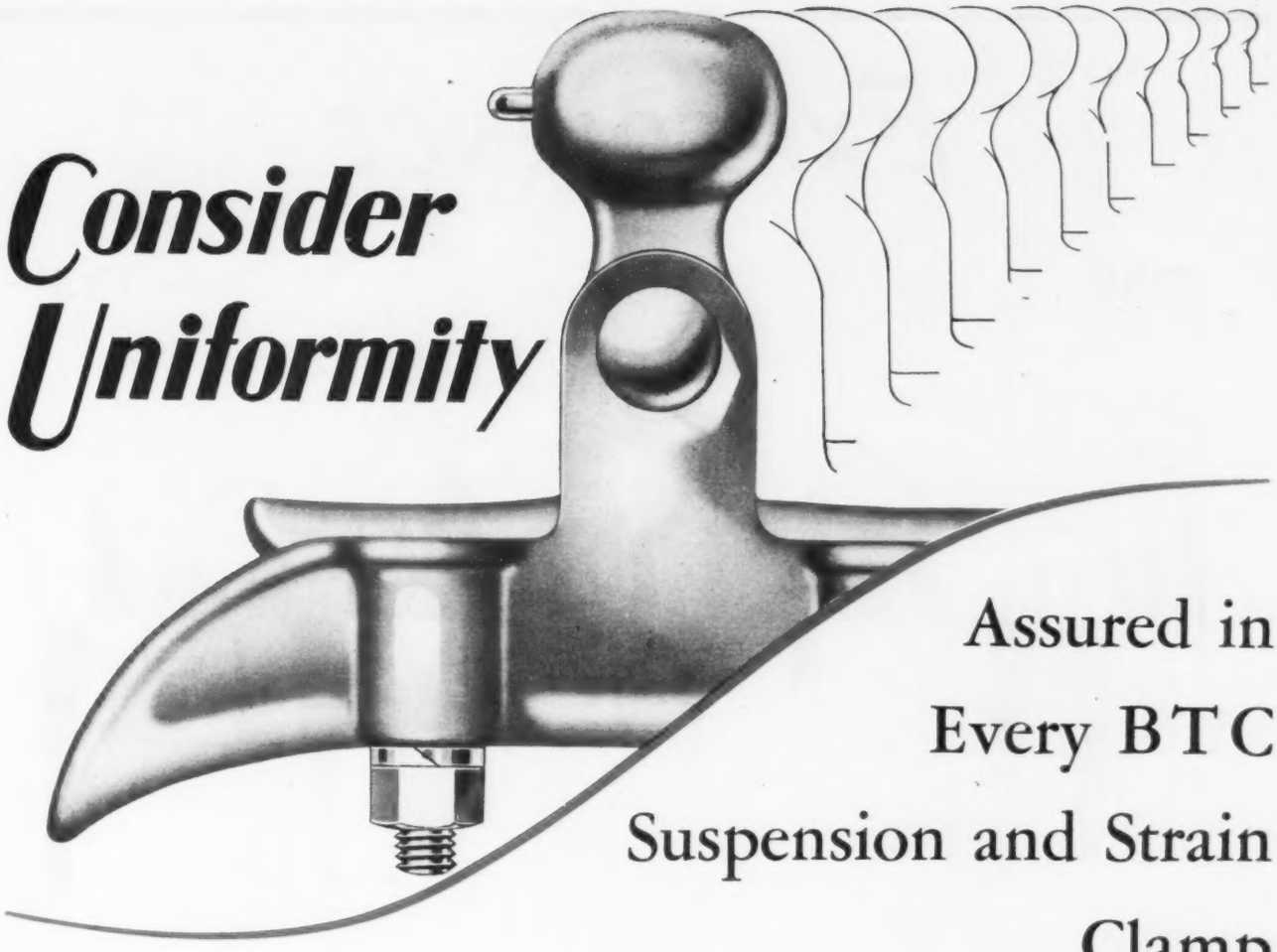
"MEGGER" and "MEG" OHMMETERS
for factory production tests of conductor resistance and insulation resistance.



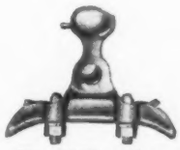
"DUCTER" Low-Resistance Testing Set
Range .000001 to 1 ohm.

"DIONIC" WATER TESTER
for testing condenser leakage and water purity.

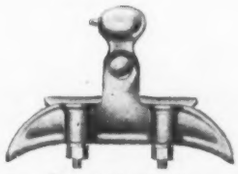
Consider Uniformity



Assured in Every BTC Suspension and Strain Clamp

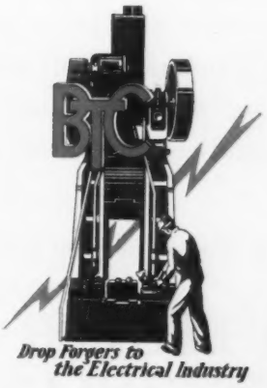


No. 2200 series



No. 3600 series

No. 4000 series Strain



Drop Forgers to the Electrical Industry

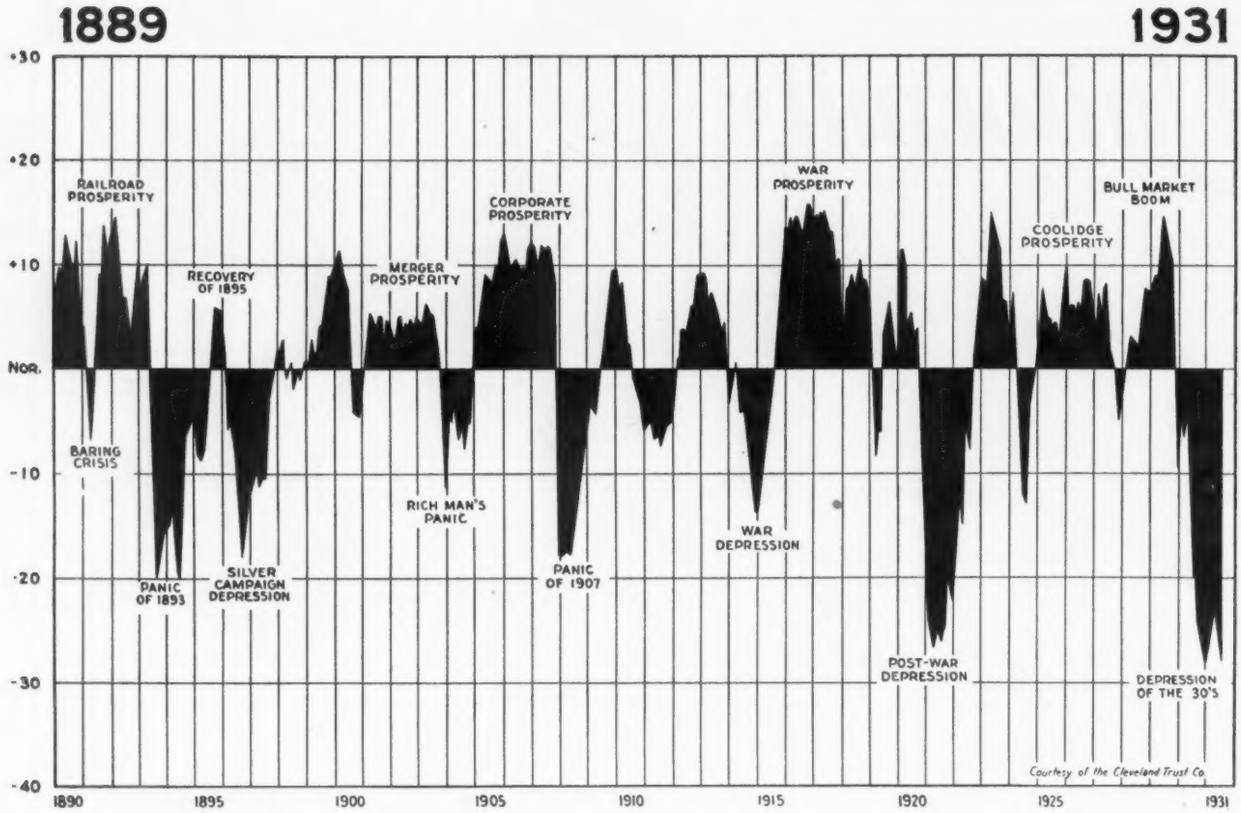
Four styles, ranging from three to seven sizes in each style and everyone uniform, strong and accurately produced. From the inexpensive pressed steel suspension to the drop forged strain clamp; engineers have found them an added margin of safety to their lines. Like all BTC hardware they are made from anti-corrosive, copper-bearing steel.

BTC clamps are designed to eliminate surplus weight and loose parts and to obtain the best possible take off angles and seat contour with an absence of corona inducing edges. Machined to the finest degree of accuracy and hot dip galvanized, they present a product to satisfy the most exacting engineer.

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

ASK YOUR INSULATOR MANUFACTURER

EXPERIENCE



Engineering reports based on sound business judgment, and accurate appraisals are assisting in the necessary business readjustments of today just as they did during other unusual business periods. Since 1889 we have been making reports and appraisals for widely different business interests.

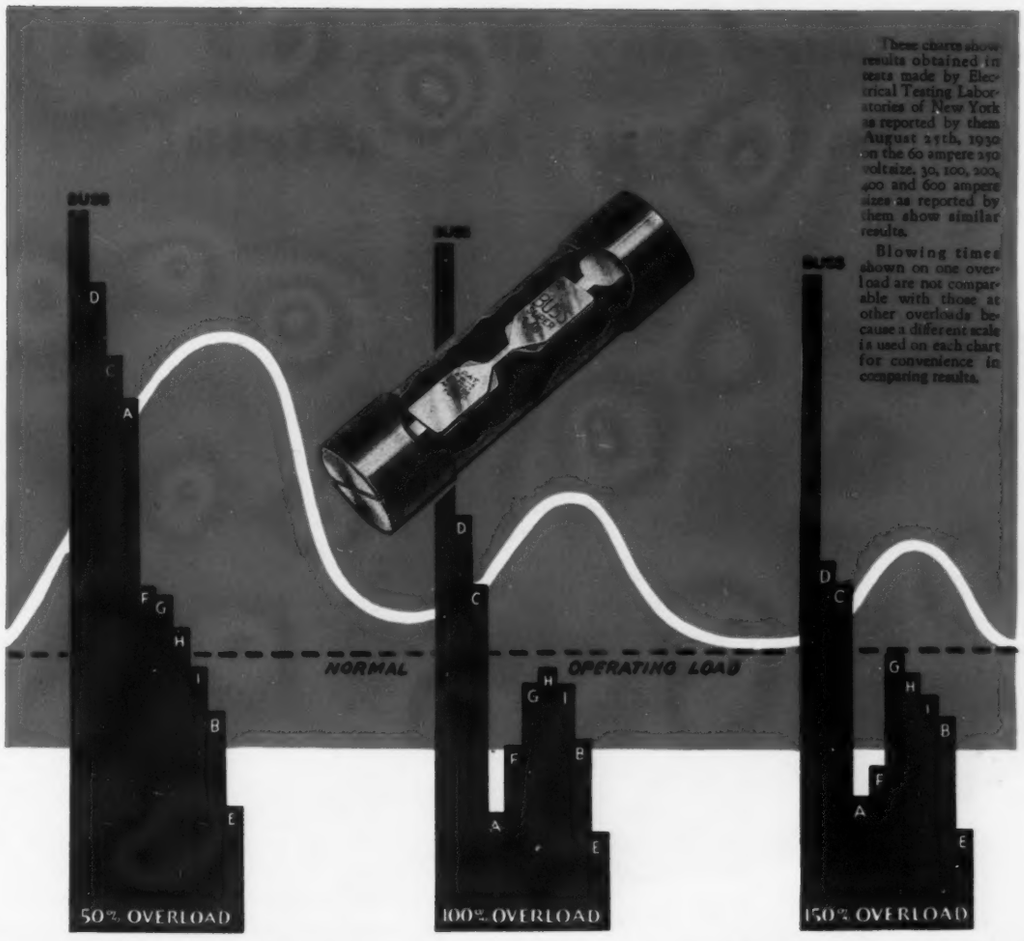
Bankers and banking houses are employing us in connection with the origination of financing or as preliminary to making loans; investment houses as a protection for their customers, and industrials and utilities for the study of present situations leading to the formation of future programs. In addition, reorganization committees find our work helpful in many problems.

For further information address our New York Office, 90 Broad Street.

STONE & WEBSTER
ENGINEERING CORPORATION

A SUBSIDIARY of STONE & WEBSTER, INCORPORATED

Associated in Canada with WILLIAM McCLELLAN and COMPANY, LIMITED, Montreal


These charts show results obtained in tests made by Electrical Testing Laboratories of New York as reported by them August 25th, 1930 on the 60 ampere 250 voltsize, 30, 100, 200, 400 and 600 ampere sizes as reported by them show similar results.
Blowing times shown on one overload are not comparable with those at other overloads because a different scale is used on each chart for convenience in comparing results.
NORMAL OPERATING LOAD
50% OVERLOAD
100% OVERLOAD
150% OVERLOAD

REDUCE *the* WAGES
YOU PAY TO HARMLESS OVERLOADS

IF you are looking for places to **SLASH COSTS**—if you want to "stop leaks" and increase operating efficiency—why not "cut the overhead salary" you pay to harmless overloads that are the cause of many needless shutdowns.

You can't get away from temporary or harmless current surges—but **TODAY** you can prevent many of the **COSTLY SHUTDOWNS** often caused by them by using a **MODERN FUSE** that will "hold" where others fail.

Just glance at the chart—see for yourself how the **NEW BUSS SUPER-LAG** Renewable **FUSE** compares with old-fashion fuses. Here at last is a fuse that will blow **SAFELY** to protect equipment—yet has a time-lag long enough to carry many of those harmless overloads heretofore so difficult to combat.

Why continue to "pay wages to harmless overloads" that cripple production and wreck operating efficiency? Why not use a fuse that will help you keep machines running—lights glowing—workers busy—and overhead costs to a minimum.

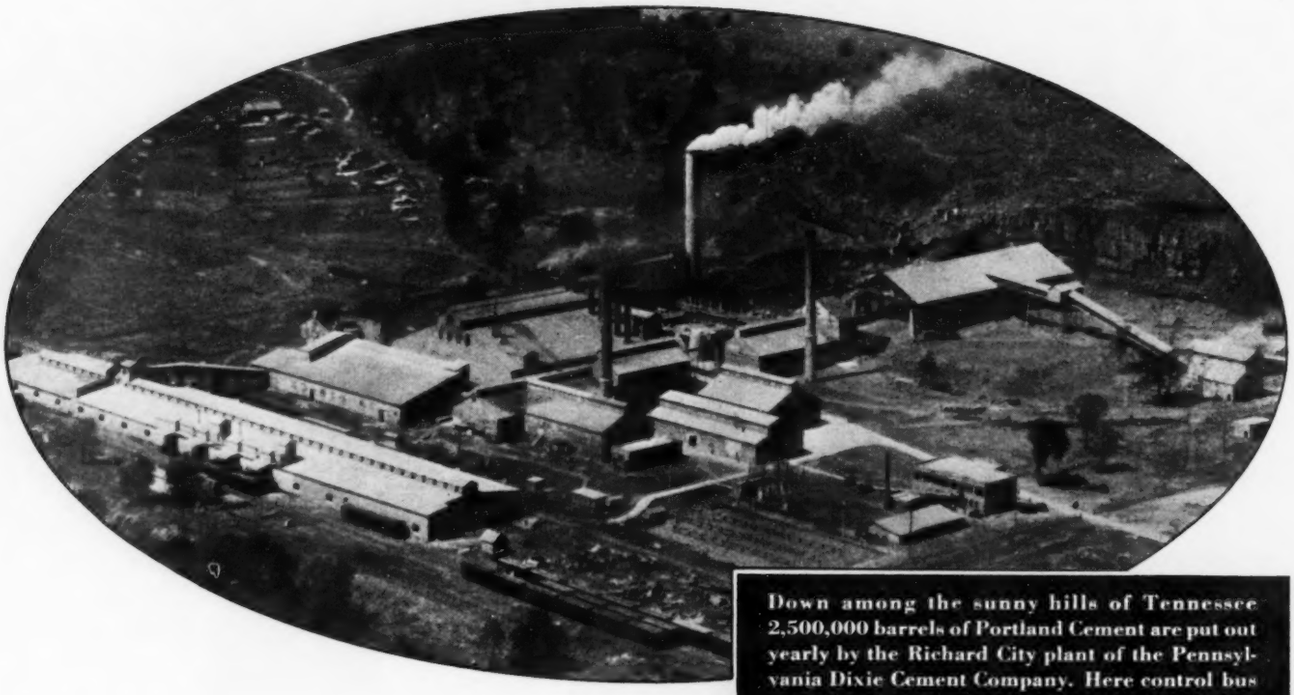
Start Cost Cutting Right at Your Desk

Why not do the simple and practical thing and give this modern fuse a trial throughout your plant. Even the first cost is no more than most old-fashion fuses. At the end of the year check up and see how operating efficiency has been increased, and fuse bills have been reduced. If you would like to know more about **BUSS SUPER-LAG Fuses** before ordering them from your distributor, complete information will be sent by mail or we will have a representative call, whichever you prefer.

THE BUSSMANN MANUFACTURING CO., St. Louis, Mo. **FUSE**
A Division of the McGraw Electric Company

BUSS SUPER-LAG

Does 24-hour-a-day GUARD DUTY for large industrial



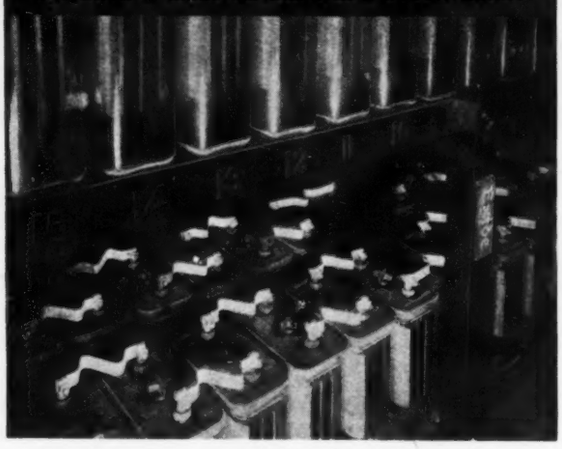
Down among the sunny hills of Tennessee 2,500,000 barrels of Portland Cement are put out yearly by the Richard City plant of the Pennsylvania Dixie Cement Company. Here control bus operation is made certain with a 60-cell Exide.

60-cell Exide Battery assures Pennsylvania Dixie Cement Company, at Richard City, Tenn., of uninterrupted control bus service—every second of the day—365 days a year

CHANCE finds a closed door at the Richard City, Tenn., plant of the Pennsylvania Dixie Cement Company. Absolutely dependable control bus operation is *made certain* with a 60-cell Exide Chloride Battery. This battery also supplies current for emergency lights in power plant.

Absolute dependability, long life, and economy of operation are the reasons Exide Batteries are specified time after time by America's leading industrial plants and power stations.

Remember this—when you buy an Exide Battery you are buying forty-three years' battery-building experience, plus a battery that has *proved* its worth by its performance.



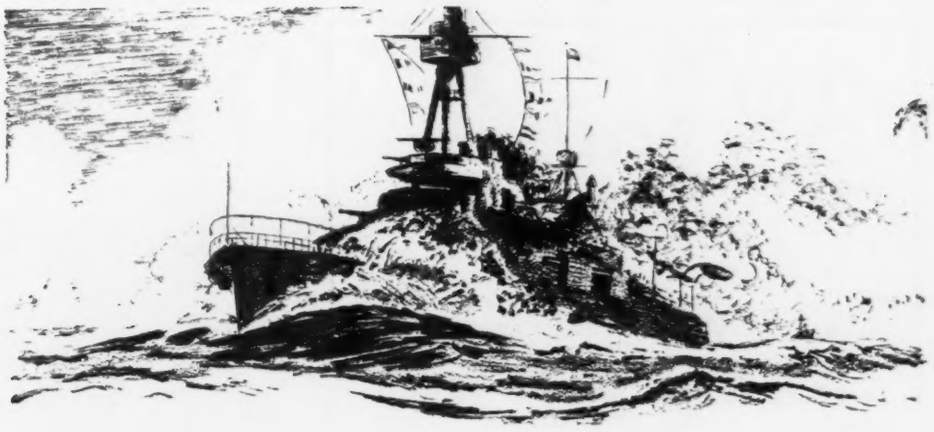
A vigilance that never ceases. This 60-cell Exide Chloride Battery assures the Pennsylvania Dixie Cement Company of absolutely dependable control bus operation, and current for emergency lights in power plant. Battery is kept charged automatically.

Exide
BATTERIES

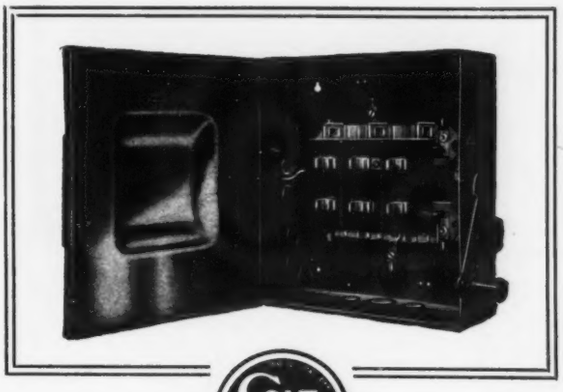
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto



Dependability!



Bulwarks against inroads of forces that destroy—protection for industry as time-honored, as essential as the battleships that guard our coast.

Such is COLT-NOARK.

In many of our large industrial plants, COLT-NOARK Quadbreak switches are the first line of defense against the destructive arc of highly inductive circuits, protecting men and equipment.

Four breaks in each leg of the circuit, and a new sliding, self-aligning type of switching prevent arcing. Disconnection of both line and load makes fuse removal doubly safe. The DEPENDABILITY of these switches has been so well demonstrated that men in industry know they are safe to operate.

Dependability has been built into all COLT products for nearly a century, and NOARK devices are also COLT built. Have you received your copy of COLT-NOARK catalog "A" describing and illustrating our electrical material? An interesting publication, "The Rampant Colt" will be mailed on request.

COLT'S PATENT FIRE ARMS MFG. CO.

ELECTRICAL DIVISION

Established 1836 : : Electrical Division 1886

HARTFORD, CONN., U. S. A.

BOSTON **CHICAGO** **NEW YORK** **PHILADELPHIA** **SAN FRANCISCO**

M-2-31

38 *years' service*

has proved the superiority of

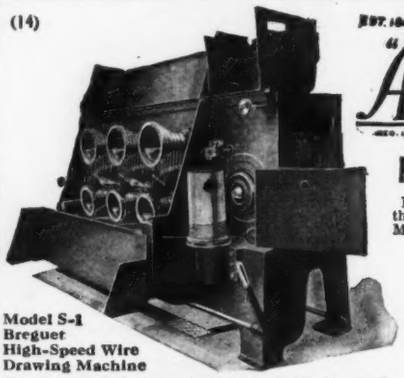
ORANGEBURG FIBRE CONDUIT

THE thousands of miles of Orangeburg Fibre Conduit in use today vouch for its dependability in protecting underground circuits. Supplied in uniform lengths, it is easy to install, costs little to handle. Stocks carried at the manufacturing plants in Orangeburg, N. Y.; Richmond, Ind., and in all larger cities insure prompt shipments.

The Fibre Conduit Co.
ORANGEBURG, N. Y.

SOLE SELLING AGENT **Johns-Manville** 292 Madison Ave., N. Y.C.

(14)



Model S-1 Breguet High-Speed Wire Drawing Machine
Can be supplied for a maximum of 25 dies and draws the finer sizes of copper wire at a finishing speed of 4000 to 4500 feet per minute.

EST. 1885 AIMco INC. 1918
"American" INSULATING MACHINERY COMPANY
519 Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

EXCLUSIVE AGENT FOR the United States, Canada, Mexico, Central and South America of the
"BREGUET" HIGH-SPEED WIRE DRAWING MACHINES
Patented in the United States, France and Great Britain.
SEND FOR CATALOG

Monson Slate

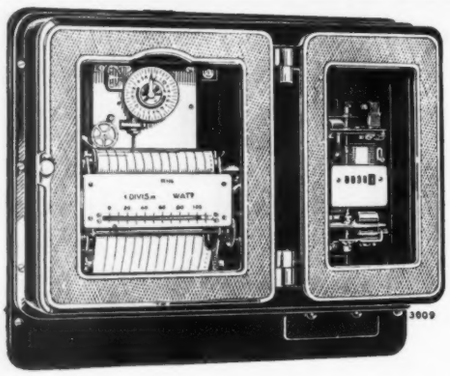
For High Grade Electrical Equipment

For Switchboards, circuit breakers, compensators and similar electrical equipment Monson Slate is recognized as the best.

We have just completed additions to our producing facilities which provide for double our former capacity. Thus manufacturers of electrical apparatus are assured prompt attention and quick shipments.

Write us your needs NOW

Portland-Monson Slate Company
Portland, Me. *Quarries* at Monson, Me.



The MAXIGRAPH

Chart Recording Demand Meter

No Ink

No excessive burden on meter element

For any demand interval in practice—also in combination with the L & G Trivector and Summation Meter.

Accurate, Reliable, Easily maintained.

Know

LANDIS & GYR

METERS AND TIME SWITCHES

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Herbert Nehls, *Vice-Pres. and Gen. Mgr.*

—GROUNDOMETERS—

For all classes of ground resistance tests

BORDEN ELECTRIC CO.
Newark New Jersey

CANADIAN PORCELAIN CO., LTD.,
HAMILTON, ONTARIO, CANADA
Specializing
High and Low Voltage Insulators

HARD PORCELAIN
For Electrical Specialties
IMPERIAL PORCELAIN WORKS Inc.
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High Dielectric Strength
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A leader for forty years.
D. M. Steward Mfg. Co.
Chattanooga, Tenn.

Like new always

because it is packed in oil

REMOVE another roll of Empire Tape from the can, weeks, months, even years after the first rolls were used. Note how very flexible this insulation remains; how uniformly smooth the finish. It never grows old while submerged in oil.

Not only is this true of the physical properties, but also of the electrical characteristics. Dielectric strength is very high. Then, too, the dielectric power factor of Empire Oil Packed Tape is very low, a characteristic that makes it ideal for insulating joints of paper covered cables, and other insulated conductors.

Empire Oil Packed Tape is one of several forms of varnished insulations made by the Mica Insulator Company. Helpful information to assist you in deciding which form is most suitable for a given service is contained in our Catalog No. 87. A copy is yours for the asking, and so is our cooperation.

"An Electrical Insulation for Every Purpose"

Lamicoid laminated Bakelite sheets, tubes and rods. *Micanite* and *Super-Micanite* built-up mica in sheets, tape, tube and rod form. *Mica* varnished cloth and paper—varnished cambric tubing, etc. Write for Catalog 87 to 200 Varick St., New York or 542 So. Dearborn St., Chicago.

Sales Offices and Stocks at Cleveland, Pittsburgh, Cincinnati, San Francisco, Seattle, Birmingham, Los Angeles, U. S. A.; Montreal, Toronto, Canada. *Factories at* Schenectady, N. Y. and London, England.

MICA INSULATOR COMPANY

Electrical Insulations

A Type For Every Purpose

Linemen!

This handy "how-to-do-it" book answers hundreds of questions

THIS practical, pocket-size manual gives you quick, accurate information on every phase of line wiring and maintenance. Packed from cover to cover with methods, kinks, short-cuts, tables, diagrams, and photographs, it is the daily reference book for linemen, wiremen, electricians, maintenance men, and transmission foremen everywhere.

The Lineman's Handbook

By EDWIN KURTZ

Member A.I.E.E.; Professor of Electrical Engineering and Head of Department, Oklahoma Agricultural and Mechanical College; formerly Member of the Educational Department, Milwaukee Electric Railway and Light Company.

542 pages—semi-flexible—pocket size
603 illustrations, $4.00

DO YOU WANT the latest data on testing, leak-locating, trouble-shooting? Do you want to know anything about guy materials? This book discusses them thoroughly. Are you interested in quick, workmanlike tower and pole erections? This book tells you step-by-step how experienced foremen go about this work. Wouldn't you like dependable information on every little detail of the lineman's work right at your fingertips? This amazing handbook gives you all these facts, and more. Glance over the chapter summary! Could any handbook be more comprehensive?

CHAPTER HEADINGS

I. Elementary Electrical Principles.
II. The Electrical System.
III. Distribution Systems.
IV. Line Materials.
V. Line Equipment.
VI. Line Protective Equipment.
VII. Line Control Equipment.
VIII. Fundamentals of Line Design.
IX. Pole Line Erection.
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XI. Inspection Testing and Maintenance.
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See that it can answer all your everyday questions—solve all of your everyday problems. Everything is plain and practical—usable and up-to-the-minute.

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McGraw-Hill Book Co., Inc., 330 West 42d Street, New York.

You may send me Kurtz's THE LINEMAN'S HANDBOOK ($4.00) for 10 days' free examination. I agree to remit for the book or return it, postpaid, within 10 days of receipt.

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W. 12-26-31

1 watt — Bulb G10

Low-wattage, long-life lamps for use on commercial voltages

NEON GLOW LAMPS

2 watt — Bulb S14
Finish — Clear, sprayed red or yellow

0.5 watt—Bulb G10
Supplied in 1.0 watt for 220, 230, 240 volts

NEON GLOW LAMPS have a great variety of practical and economical uses: As night lights, guide and pilot lights in the home. In industry, as signals and pilots on electrical circuits, automatic machinery, remote controls, quiet motors. In laboratory, as stroboscopes, oscillators, etc. Fit standard socket. Average life, 3,000 hours. Extremely economical! Write for prices and details to General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, New Jersey.

GENERAL ELECTRIC
VAPOR LAMP COMPANY

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before placing your order for
SWITCHES CLAMPS
LIVE LINE TOOLS

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Line and Station Equipment

We are prepared to bid on equipment in a wide price range and can quickly and efficiently produce to meet any peculiar operating or structural condition.

Low Overhead — Factory-Direct Policy

Johnson Manufacturing Company

"Safe, Practical Design and Masterly Workmanship"

P.O. Box 359, ATLANTA, GEORGIA

15 KV.

1200 Amp.

Elpeco Indoor Switch
—with special
tube lug terminals

ELECTRIC POWER EQUIPMENT CORP.
412-20 N. 18th St., Philadelphia, Pa.

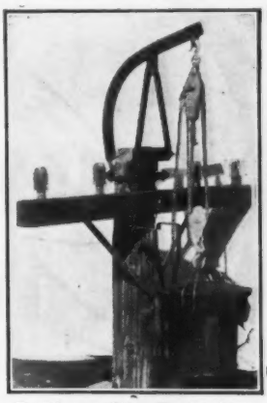
NEW CONSTRUCTION AND MAINTENANCE EQUIPMENT FOR THE ELECTRICAL INDUSTRY

One man on each side of tower with Model F Coffing Hoist is able to pull sufficient slack to install strain type insulators.

The man on the right is pulling 1000 feet and the man on the left 700 feet of 4-0 conductor.

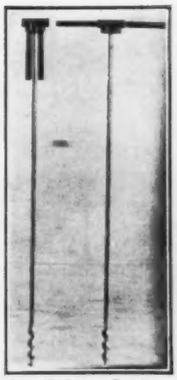
Height of Tower: 75 feet.

Coffing Hoists
The Universal Tools

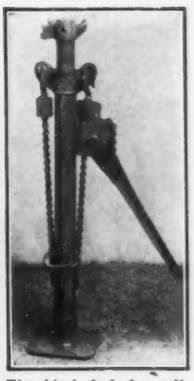


Transformer Gin. Can be clamped securely to top of poles. For lifting transformers.

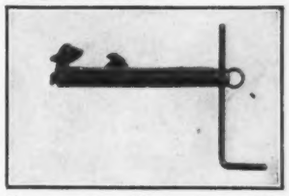
The Power & Light Companies have found them especially adapted to line construction and maintenance work. These hoists are replacing the block and rope on account of their compactness and the fact that one man can pull as much with one of them as several men can pull with a large block. Rain, mud and snow will not affect their operation. Weight, 14 lbs. to 65 lbs. Capacity, ¾ ton to 6 ton.



Ground Auger for temporary grounding in all kinds of earth. Easy to remove from the ground. Collapsible handle makes it compact. Easy to remove it under other tools.



The Ideal Jack for pulling and straightening poles. It has tilt and swivel base.



Temporary Guy Clamp. For necking guy wires under heavy tension. 3 bolt clamp can be put in proper location without using hammer.

Temporary Crossarm and Clamp. They can be readily clamped to a pole above or between the crossarms. For changing crossarms on corners or on pole lines.

Has a tilting hook with automatic lock, large enough to hold a 1¾-in. line hose. Prevents current from arcing from one hook to another in wet weather.

Flag, flag holder and electric light. For poles, pipes, etc., in transit day or night. Can be easily attached and removed. Spring attached to chain so holder will not work loose.

Any of this equipment can be secured on 30 days' trial.

Catalogue with full information will be sent on request.

Coffing Hoist Company
313 E. Van Buren St., Danville, Illinois

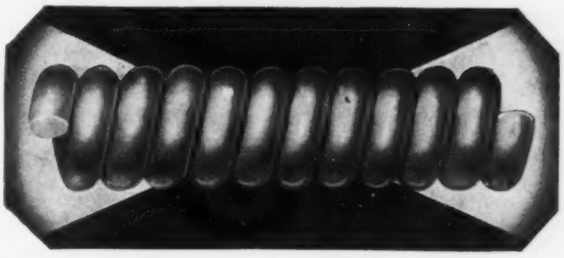
SIMPLEX Non-Metallic Underground Cables

Simplex Non-Metallic Underground Cables are made in two types; a weatherproof type protected by a series of weatherproofed tapes, and a rubber jacket type protected by a rubber sheath and weatherproofed tapes.

Simplex Cables with non-metallic protection are acid, alkali and waterproof. The conductor insulation and the rubber sheath are specially designed submarine type rubber compounds. The cables are lighter in weight and more flexible than cables protected by metallic armor. They are less expensive and have a wider range of usefulness than other types of underground cables.

Write for descriptive booklet.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST., BOSTON



Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

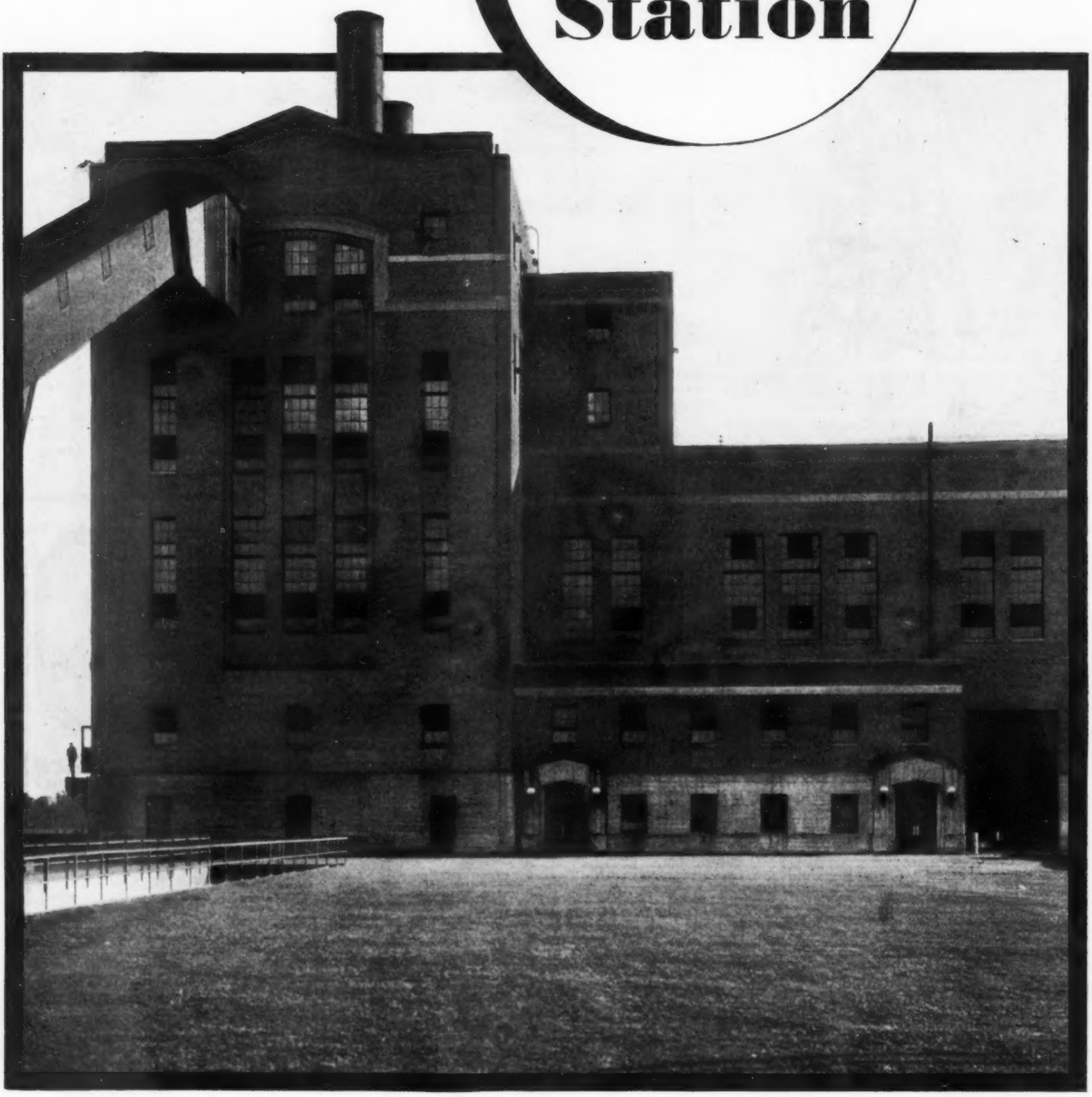
Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

INDIANA STEEL & WIRE CO. Crapo Galvanized MUNCIE, IND.

Crapo
GALVANIZED PRODUCTS

The New Picway Ohio Station



GARGOYLE

Lubricating Oils

VACUUM OIL

61 BROADWAY, NEW YORK CITY

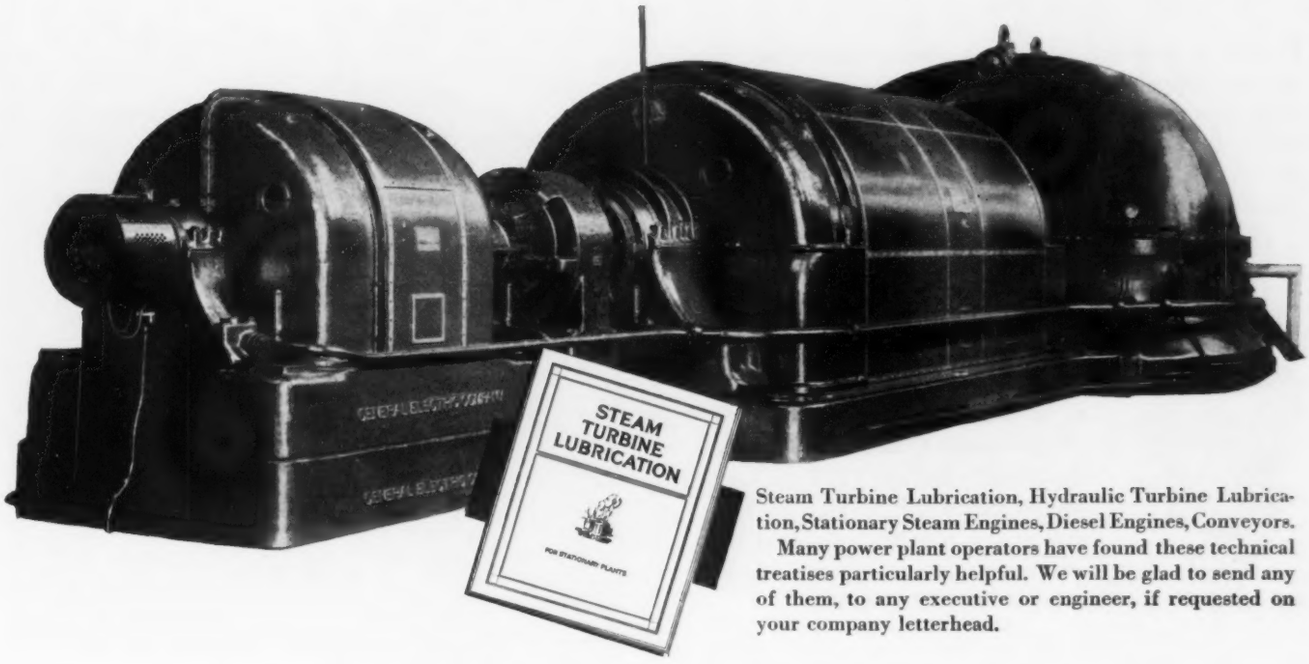
Smooth flow of 60,000 k.w.

Safeguarded by Gargoyle D.T.E. Oil Light

IN supplying electricity and street railway service to a population of 350,000 in Columbus, Ohio, and adjacent territory, the Columbus Railway Power & Light Company has been continually expanding its facilities.

This new station provides for an ultimate capacity of 150,000 k.w., of which 60,000 k.w. is already installed and in service.

The modern Picway Station is another addition to the large group of leading American power producers who safeguard costly modern equipment and maintain continuous electric service by the use of Gargoyle Lubricating Oils and Vacuum engineering service.



Steam Turbine Lubrication, Hydraulic Turbine Lubrication, Stationary Steam Engines, Diesel Engines, Conveyors.

Many power plant operators have found these technical treatises particularly helpful. We will be glad to send any of them, to any executive or engineer, if requested on your company letterhead.

COMPANY, INC.

BRANCHES AND WAREHOUSES THROUGHOUT THE WORLD

Explosion-proof Motor Starters

TESTED AND LISTED by the Underwriters for Class 1, Group D Hazardous Locations

The illustrations to the right show the new EC&M No. 1 Type ZEO Explosion-Proof Motor Starter which is now listed by the Underwriter's Laboratories for use in Class 1, Group D Hazardous Locations.

The official approval permits this starter to be used with standard squirrel-cage motors of the following ratings: 1-5H.P., 110 volts, and 1-10H.P., 220, 440 and 550 volts. The starter is also so designed that it is capable of providing safe operation when used with low starting inrush current motors of the following ratings: 1-5H.P., 110 volts; 1-10H.P., 220 volts, and 1-20H.P., 440 and 550 volts.

EC&M is prepared to furnish many other types of starters designed and built to fulfill the Underwriter's requirements for Class 1, Group D Hazardous Locations. Reduced voltage, compensator-type and similar starters for low and high voltage squirrel-cage and synchronous motors are available.

The EC&M Type EO Explosion-Proof Push Button has also been tested and is now listed by the Underwriters for use, either with or without oil, in Class 1, Group D Hazardous Locations. It may also be used wherever corrosive or adverse atmospheric conditions are prevalent. It is completely described in Bulletin 1105-E. Our nearest office will be glad to send you a copy, together with complete information describing the starter suitable for your purpose.

TESTED and LISTED

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

NEW YORK-50 CHURCH ST.
CHICAGO-CONWAY BLDG.
DETROIT-DIME BANK BLDG.
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KANSAS CITY, MO.-3241 THE PASEO.
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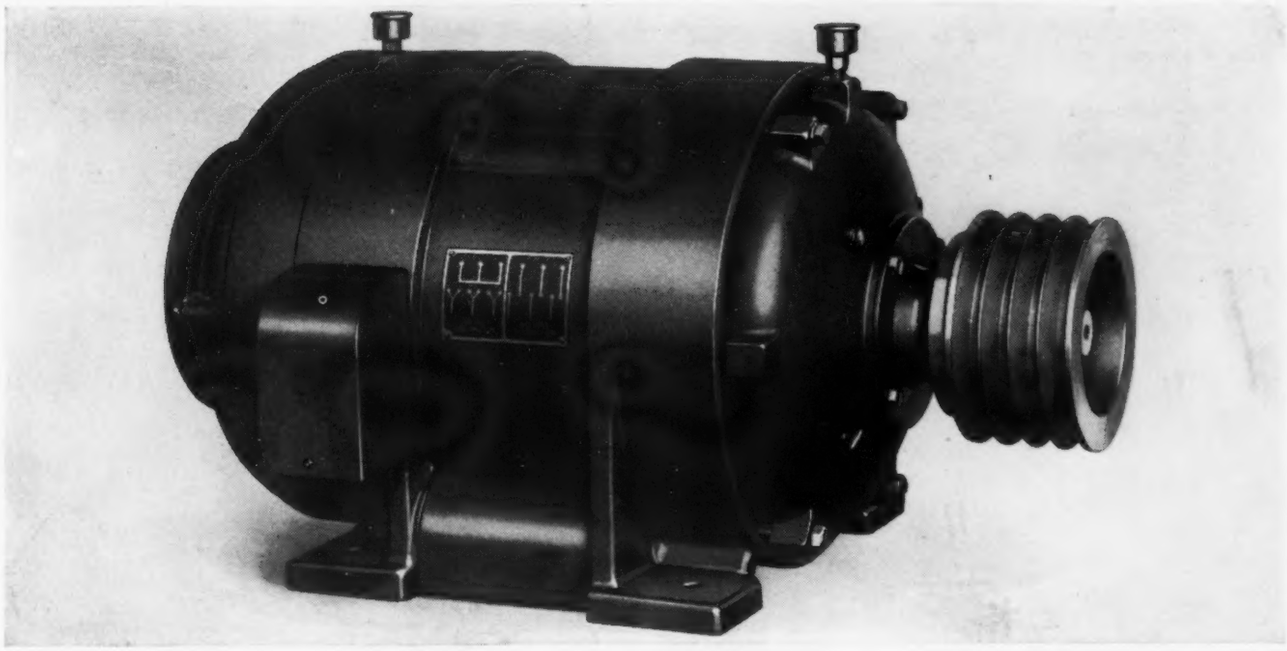
TORONTO-REFORD BLDG.
PHILADELPHIA-WITHERSPOON BLDG.
PITTSBURGH-OLIVER BLDG.
SAN FRANCISCO-CALL BUILDING
MONTREAL-CASTLE BLDG.
BUFFALO-888 COLVIN BLVD.
SEATTLE-2207-1ST AVE. SO.



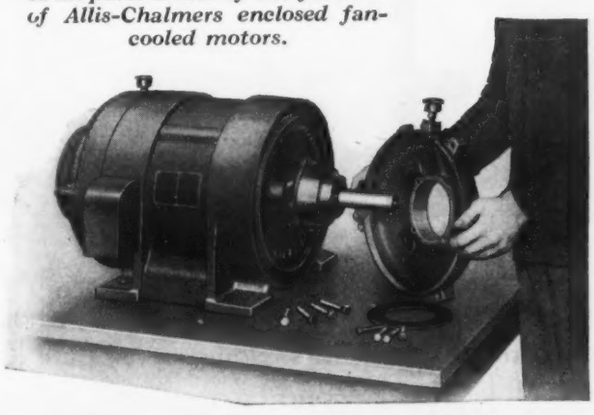
Your Maintenance Man Knows
the Value of these Enclosed Motors

HE knows that where dust, dirt, moisture, dripping water, or destructive gases are present . . . . those drives in out of the way places where motor windings become clogged or moisture soaked . . . . there, Allis-Chalmers enclosed fan-cooled motors reduce trouble and operating expense.

He knows that sturdy construction, liberal design, and unexcelled insulation are features of Allis-Chalmers motors and that the enclosed-fan-cooled type, while thoroughly protected, is readily accessible.

Allis - Chalmers enclosed fan - cooled motors approved by the Underwriters for dusty locations are described in Leaflet 2124. Explosion-proof motors, also approved, are described in Leaflet 2125-A.

Complete and ready accessibility to all parts is one of the features of Allis-Chalmers enclosed fan-cooled motors.



Allis-Chalmers Mfg. Co., Milwaukee

ALLIS-CHALMERS MOTORS

Courtesy of Lincoln Electric Co.

A BLESSING—in disguise. This weird looking individual is a god-send to din-ridden city folk. Because he works silently. The whole electrical industry is interested in the work he's doing—WELDING WITH ELECTRICITY—which "Electrical World" consistently advocates. Through its pages, the important influences throughout the industry that are practically concerned with electric welding, and the men who actually specify and supervise its use, are continually informed as to definite applications and cost figures proving its worth.

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Box Numbers in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

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E.W.

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ELECTRICAL ENGINEERS AND EQUIPMENT

803 Williams St. North Bergen, N. J.

Telephone: Palisade 2600-2601

MOTOR GENERATOR SETS

1—500-kw., 250-V., Westinghouse Synchronous motor Generator Set.
1—300-kw., 125-V., 3-wire, 3-unit, Ridgeway.
1—500-kw., 250-V., Westinghouse Synchronous motor Generator Set.
1—250-kw., 230-V., 3-ph., 60-cy., 2300-2600-V. Synchronous Motor Generator Set.
1—200-kw., 230-V., 3-ph., 60-cy., 2300-4100 -V. Synchronous Motor Generator Set.
1—150-kw., 600-r.p.m., 250-V., Gen., 3-ph., 60-cy., 220-440-V., G.E. Synchronous motor.
1—125-kw., 250-V., Westinghouse Synchronous Gen. Motor Set, 3-ph., 60-cy., 230-2200-V.
1—100-kw., 125-V., D.C., 220-440 A.C., G.E. Synchronous Motor Generator Set, 220-440-V.
1—100-Kw., 250-V., Gen., 900-r.p.m., 2200 Synchronous Motor.

TURBINES

1—75-kva., 3-ph., 60-cy., Westinghouse Geared Non-Condensing Turbine.

TRANSFORMERS

1—1500/3000-kva., G.E., combined oil and water cooled 3-ph., 60-cy., 11000-22000-2300-V.
3—50-kva., G.E., 13000/26000—220/40.

A. C. GENERATORS

No.	Kw.	R.p.m.	Volts	Ph.	Type
1	400	900	2300–4000	3	Westg.
1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230–2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220–440–2300	3	G.E.

MOTORS—3 Phase, 60 Cycle

No.	Hp.	R.p.m.	Volts	Type
1	500	900	440/4000	Westinghouse Syn.
1	500	900	440-2200	G. E. Syn.
1	350	900	2200/4000	Wh. syn.
2	300	600	445-2300	G.E. syn.
1	250	600	2200/4000	G.E. syn.
1	250	600	220–440	Westg. syn.
1	250	600	440–2200	G.E. syn.
3	200	514	4150–2300	G.E. syn.
2	175	3-ph.	60-cy.	2300-volts, G.E.
4	150	1200	220–440	Westg., sl.rg.
1	150	900	2200	G.E., syn.
2	150	514	2200	Westg. sl. rg.
1	150	1800	2200	West. sq. cg. mfr.
1	100	900	440/2200	G.E. sq. cg.
1	100	900	220–440–220	Westg. sq. cg.

D. C. GENERATORS

No.	Kw.	R.p.m.	Volts	Type
1	200	900	250	G.E.
1	200	600	250	G.E.
1	200	525	250	G.E.
2	150	1200	250	Cr.-Wheeler
1	150	600	250	G.E.
2	150	1200	250	Westg. new
1	100	720	250	G.E.
1	75	450	250	Diehl

(Smaller Sizes on Request)

D.C. MOTORS—230 VOLT

No.	Hp.	R.p.m.	Type
1	250	550	G.E.
2	200	1150	Cr.-Wheeler
1	150	600	G.E.
3	150	850	Westg. SK., new
1	150	1100	Westg. SK.
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1—75/100	500/1000	Croc.-Wheeler	CMC
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(Continued from page 31)

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TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 14, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., January 11, 1932, for furnishing the materials and performing the work required for installing one passenger elevator in the U. S. post office, court house, etc., extension and remodeling, at Americus, Ga. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a "statement of facts as to qualifications to furnish elevators in strict accordance with the specifications" in detail of such data as may be required including the business and technical organization of the bidder available for the contemplated work, financial resources, building experience, material proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, or materials proposed to be used, justify such rejection. The successful bidder will be required to furnish a performance bond of 50 per cent of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931, (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (261)

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TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 14, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., January 11, 1932, for furnishing the materials and performing the work required for installing a complete elevator plant in the U. S. post office, court house, etc., at Texarkana, Arkansas and Texas. All prospective bidders are hereby notified that, prior to the award of the contract, architect to require any or all bidders to submit a "statement of facts as to qualithe right is reserved by the supervising fications to furnish elevators in strict accordance with the specifications" in detail of such data as may be required including the business and technical organization of the bidder available for the contemplated work, financial resources, building experience, material proposed to be used, etc. The United State expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (264)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 11, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., January 5, 1932, for furnishing the materials and performing the work required for installing a complete elevator plant in the U. S. post office, court house, etc., at Montgomery, Ala. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a "statement of facts as to qualifications to furnish elevators in strict accordance with the specifications" in detail of such data as may be required including the business and technical organization of the bidder available for the contemplated work, financial resources, building experience, material proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (263)

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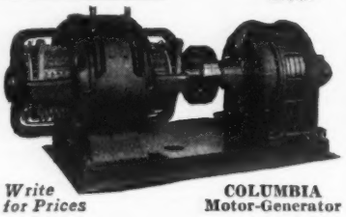

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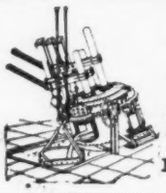

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3 MAJOR DEVELOPMENTS IN AIR CIRCUIT BREAKERS

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RE-AX-ITE

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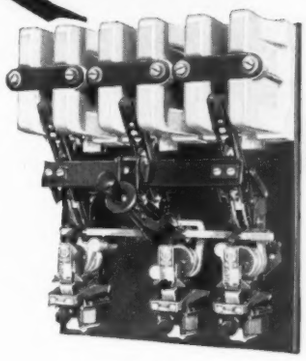

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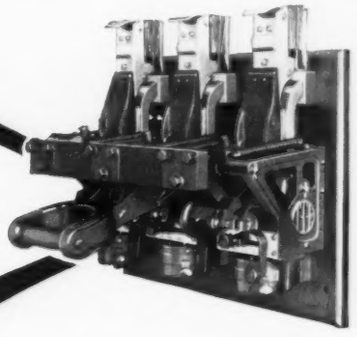

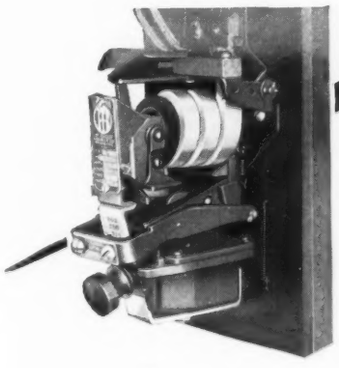

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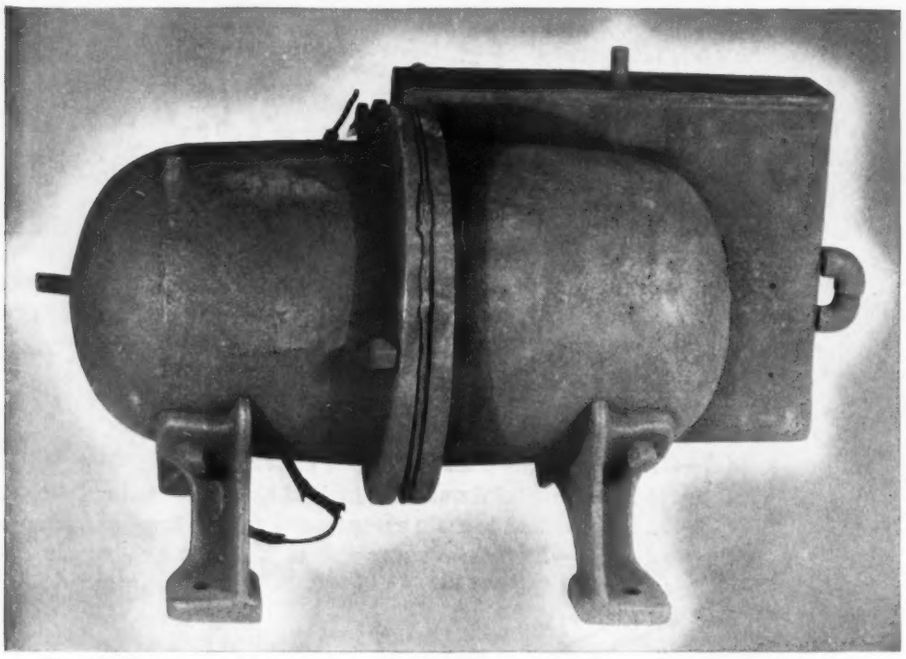
Which is more up-to-date?

This ancient transformer



An old Hedgehog transformer, courtesy Museum of Science and Industry, Chicago.

or your fire protection methods?

HEDGEHOG transformers like this are museum pieces today. Efficiency demands that many of the fire extinguishers still found in power plants be consigned to museums, too.

To find the reason for this compare the efficiency of liquid extinguishing agents with that of Lux CO_2 gas. Lux gas is the quickest extinguishing agent known to man. Moreover, being a non-conductor, it can be applied to flaming apparatus before the potential has been removed.

Lux gas is absolutely clean, dry and harmless. It cannot wet windings or injure insulation. And it cannot add to the fire damage or incapacitate adjacent equipment.

These are a few of the reasons why power companies are standardizing on Lux. Nine companies have replaced over 500 perfectly good extinguishers with Lux units this year. Several others are making all their renewals with Lux.

If you are still using out-of-date fire equipment, you should investigate Lux Extinguishers now—before a serious fire occurs. Complete information will gladly be sent upon request.

Walter Kidde & Company, Inc.
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LUX SYSTEM OF FIRE EXTINGUISHING

Not smoke, but a blanketing cloud of Lux gas, which puts out fires instantly and without damaging after effects —the modern way.